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THE

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NATURALIST AND GEOLOGIST.

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ARTICLE I.—*On* Fossil Plants *from the* Devonian Rocks *of* Canada. By J. W. Dawson, LL.D., F.G.S., Principal of McGill College, Montreal. (From the Proceedings of the Geological Society of London.)

In 1843–44, Sir W. E. Logan ascertained, and published in his Report* for the latter year, the occurrence of a series of beds of Devonian age in the Peninsula of Gaspé, Lower Canada, containing fossil plants, apparently of the land, and some of them evidently *in situ*. Nothing was done toward the precise determination and description of these remains until 1856, when Sir William kindly permitted the writer of this paper to examine his collection, and to describe before the American Association for the Advancement of Science the most interesting specimen contained in it—a fossil trunk exhibiting a very remarkable and previously undescribed coniferous structure†. The other specimens in the collection were so fragmentary or obscure, that it was not deemed expedient to attempt their description before studying them (as all fossil plants should, when practicable, be studied) in the rocks in which they occur. With this view I visited Gaspé in the past

* Report of Progress of Canadian Geological Survey, 1844, p. 36, and Appendix.

† Proceedings of American Association, 1856, p. 174.

summer, and examined the localities indicated on the plans and sections of the Geological Survey. The facts and specimens thus obtained will probably be fully described and illustrated in one of the forthcoming Decades of Canadian Fossils; and in the meantime I propose to notice some of the species observed, which appear to be of especial interest in the present state of our general knowledge of the Devonian flora.

Before proceeding to these descriptions, it may be necessary to state that the deposit in which the fossils occur consists of sandstone and shale, of various colours and textures, with some conglomerate and thin-bedded coarse limestone, and a seam of bituminous coal, one inch in thickness. The whole series is estimated by Sir W. E. Logan at 7000 feet of vertical thickness. It rests on Upper Silurian rocks, and underlies unconformably the conglomerates which here form the base of the Carboniferous system. Some of the beds, especially in the lower part of the series, contain marine fossils of Lower Devonian forms, which are now in process of examination by Mr. Billings of the Geological Survey. The greater part of the beds are, however, destitute of marine fossils, and present appearances indicative of shallow water and even of land-surfaces. Some of the species of plants occur throughout the whole thickness; but the bed of coal and most of the plants *in situ* are found in the lower and middle portions of the series. Detailed sections and descriptions of the beds will be found in the Report above referred to.

1. Psilophyton, gen. nov. (Figs. 1 & 2.)

Lycopodiaceous plants, branching dichotomously, and covered with interrupted ridges or closely appressed minute leaves; the stems springing from a rhizoma having circular areoles, sending forth cylindrical rootlets. Internal structure: an axis of scalariform vessels, surrounded by a cylinder of parenchymatous cells and by an outer cortical cylinder of elongated woody cells (prosenchyma). Fructification probably in lateral masses, protected by leafy bracts.

The most remarkable and interesting plant of the formation is one which, I believe, has frequently been observed and described elsewhere from fragmentary specimens, but which occurs in the

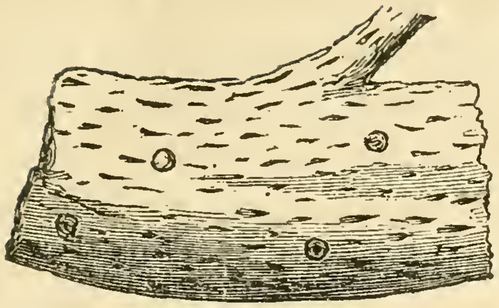


Fig. 1 *a*

Fig. 1 *d*

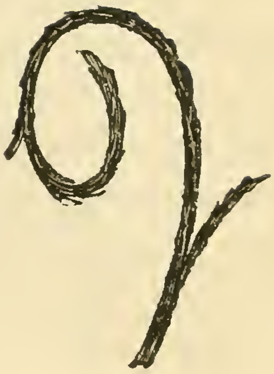


Fig. 1 *c*

Fig. 1 *f*

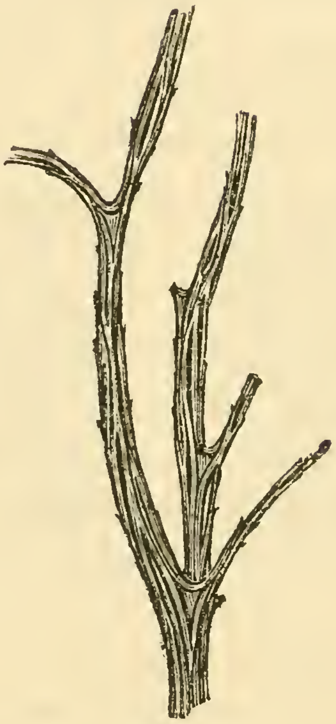
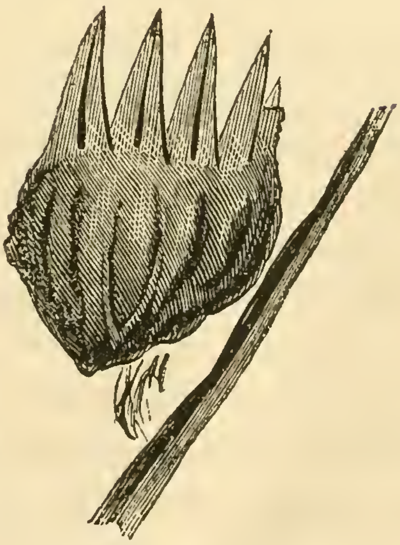


Fig. 1 *b*



Fig; 1 *e*

Fig. 1.—*Psilophyton princeps.* *a*, rhizome; *b*, stem; *c*, termination of branches; *d*, vernation *e*, fructification; *f*, restoration.

Gaspé sections in a state of perfection unusual with palæozoic plants. It is characterized by slender, bifurcating, ridged stems, proceeding from a horizontal rhizoma, which sends forth numerous rootlets. The rhizomata, evidently *in situ*, clothe some beds of indurated clay with a mat of creeping and occasionally bifurcating cylindrical stems, filling the beds below with their vertical rootlets. They attain a diameter of an inch or more, though usually smaller, and a length of at least three feet. They are irregularly dotted with minute linear punctures, the marks probably of ramenta ; and at intervals there are circular areoles with central pits, like those of *Stigmaria*, but irregularly disposed, and giving origin to the roots, which, however, unlike those of *Stigmaria*, subdivide in descending into the soil. Apart from the stems, these rhizomata might be included in the genus *Karstenia* or *Halonia*, or even as abnormal species in *Stigmaria* (fig. 1 *a*,). The aërial stems vary from a fourth to a tenth of an inch in diameter at their origin, rise obliquely from the rhizoma, and bifurcate very regularly. The extreme points divide nearly at right angles, and in some, probably young, branches the ultimate branchlets bend into a spiral curve with a somewhat unilateral arrangement of the leaflets. In the shale overlying the small coal-seam above-mentioned, there are immense numbers of these little branchlets, rolled so closely as to resemble spiral shells They probably indicate a circinate vernation like that of ferns. (See figs. 1 *b*, *c*, *d*.) The surface of the stems is very smooth and glossy, quite destitute of scars, but marked with numerous interrupted ridges spirally arranged, and sometimes seen to project a little at the upper ends, as if rudimentary leaves. This leaf-like character is more distinct toward the extremities of the branches; but the leaves are not sufficiently well preserved to show anything more than that they are slender and acicular.

The greater part of the specimens are flattened, with the epidermis alone preserved in a coaly state; but a few fragments were found with the internal structure remaining. It consists of a slender axis of scalariform vessels, surrounded by a space now occupied by calcspar, but showing in parts the remains of a loose cellular tissue. Externally to this is a cylinder of well-preserved, elongated, woody cells, without distinguishable pores, but with traces of very delicate spiral fibres. (Fig. 2 *g*, *h*, *i*, *k*.)

The structure and external appearance above described indicate affinities with the *Lycopodiaceæ*, and especially with the genus

*Psilotum**, with which these plants very closely correspond in all except their rhizomes and the circinate terminations of the branchlets. The name proposed above is intended to express this relation, as well as the most apparent distinction between these plants and those of the genera *Lycopodites* and *Selaginites*†. To the species above described I would give the name of *Psilophyton princeps*. I have attempted a restoration of its general appearance in fig. 1 *f*.

Fig. 2 *g*

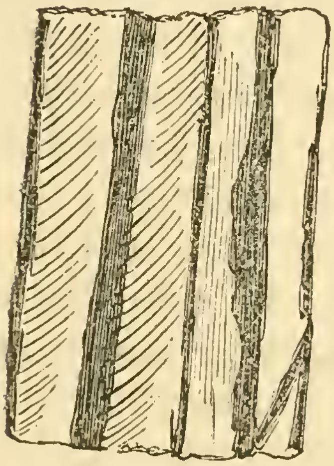


Fig. 2 *h*

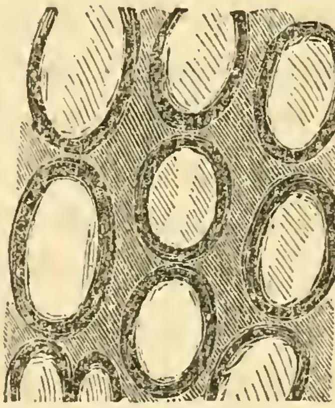


Fig. 2 *i*

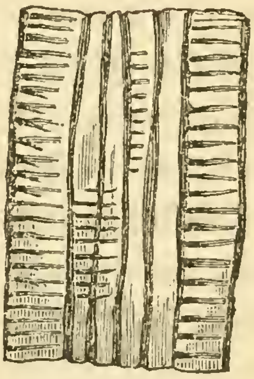


Fig. 2 *k*

Fig. 2 *g*, longitudinal section of stem, nat. size; *h*, cortical cells (300 diams.); *i*, parenchyma (300 diams.); *k*, scalariform tissue of axis (300 diams.)

Some of my specimens appear to indicate a second species, characterized by more robust stems, more finely ridged, and having slender alternate branches, which bifurcate frequently and usually bend downward. The specimens are not well preserved, but are very distinct from *P. princeps*, while probably generically related to it. I would name this species *P. robustius*.

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* See Brongniart, Vég. Fos. vol. ii. pls. 6 & 11. I have been favoured by Prof. Gray, of Harvard College, with specimens of *P. flavidum* from Tahiti and *P. triquetrum* from Australia, which closely resemble the fossils in structure and surface-markings.

† I should have preferred the term "Psilotites;" but this has been preoccupied by a Jurassic plant, of which, however, I cannot find any detailed description. See Unger, Gen. et Spec, &c. p. 279; Brongniart, Tableau des Genres, p. 41.

Neither of the species exhibit distinct fructification. Certain obscurely cuneate carbonaceous spots attached to the sides of the branches of *P. princeps* are, perhaps, of this character; and the object represented in fig. 1 *e*, which appears to be thus attached, may be an example in better preservation than usual. It consists of four thick lanceolate leaves or bracts with single midrib, arising from a flattened carbonaceous patch, which shows traces of similar leaves on its surface. These leaves or bracts have evidently enclosed the fructification of some lycopodiaceous plant; and from their association with *Psilophyton princeps*, I regard it as highly probable, though by no means certain, that they belong to that species.

The rhizomata of *Psilophyton princeps* occur *in situ* in a number of argillaceous beds, in a manner which shows that they crept in immense numbers over flats of sandy clay, on which their graceful stems must have formed a thick, but delicate, herbage, rising to the height of from two to four feet. The rhizomes and the bases of the stems may possibly have been submerged; but I should infer, from the appearance and structure of the latter, that they were rigid, woody, and perhaps brittle. In many beds in which the rhizomes have not been distinctly preserved, the vertical rootlets remain, producing an appearance very similar to that of the Stigmarian under-clays of the coal-measures. Sir W. E. Logan has noted in his detailed sections numerous cases of this kind.

When broken into fragments and imperfectly preserved, *Psilophyton princeps* presents a variety of deceptive appearances. When perfectly compressed in such a manner as to obliterate the markings, it might be regarded as a dichotomous fucoid or a flattened root. When decorticated and exhibiting faint longitudinal striæ, it presents, especially when the more slender branchlets are broken off, the aspect of a frond of *Schizopteris* or *Trichomanites*. When rendered hollow by decay, it forms bifurcating tubules, which might be regarded as twigs of some tree with the pith removed. Lastly, the young plants might be mistaken for ferns in a state of vernation. In all conditions of preservation, the stems, rhizomes, and rootlets, if separated, might be referred to distinct genera. I have little doubt therefore that many imperfectly preserved Devonian plants of this general form, noticed under various names by authors, may belong to this genus, and some of them to the species above described. In particular I may refer

to certain dichotomous fucoids in the genera *Fucoides* and *Chondrites*; to a plant from the Hamilton Group of New York, figured by Vanuxem in his Report, p. 161; to the dichotomous roots from Orkney and Caithness described by Mr. Salter in the 'Proceedings' of this Society for last year; and to the bifurcating plants with curved tendril-like branchlets figured by Hugh Miller, 'Old Red Sandstone,' plate 7, and 'Testimony of the Rocks,' p. 434. From the description in the former work, Chap. 5, it would appear that the author had observed not only the stems but the rhizomes with their Stigmaria-like areoles, though without suspecting them to belong to the same plant. I have little doubt therefore that materials exist in the Old Red Sandstone of Scotland for the reconstruction of at least one species of this genus. Various fragments which I have collected induce me to believe that it may be found also in the Lower Coal-measures.

I have noticed above the resemblance of flattened specimens of *Psilophyton* to ferns of the genus *Trichomanites* (Gœppert.) To this genus, indeed, I was disposed to refer the specimens, until I found that the internal structure was lycopodiaceous, and that the branching filaments are true branchlets covered with minute leaves. A comparison of the plants above described with *Trichomanites Beinertii* of Gœppert, and *Sphenophyllum* (*T.*) *bifidum* of Lindley and Hutton, will show at a glance the strong resemblance that subsists; and, since the specimens on which these species are founded do not appear to have exhibited internal structure or venation, I think it still admits of a doubt whether they are really ferns. By way of further caution on this point, I may remark that in flattened stems, either of *Psilotum* or of its ancient relative, the slender woody axis may leave a mark resembling the nervure of a leaf, and thus complete the resemblance to a frond of *Trichomanes*.

Since writing the above, Professor G. S. Newberry has kindly pointed out to me the close resemblance between the first species above described and *Haliserites Dechenianus* of Gœppert ('Flora der Uebergangsgebirges,' p. 88). I can scarcely doubt that this so-called fucoid is in reality a plant of the genus above described, but in such a state of compression that the stem appears like a narrow frond, and the woody axis as a midrib. As this plant is said to occur very abundantly at certain levels in the Devonian Series of the Rhine, if my suspicions as to its nature are correct

further examination might disclose its rhizomes, leaves, or fructification.*

2. Lepidodendron. (Fig. 3.)

A single species of this genus is found rather plentifully in the beds containing the plants just described, and is distinct from any that I have observed in the Coal-formation. The specimens observed were all of small size and fragmentary, nor was their state of preservation very good, though most of them were

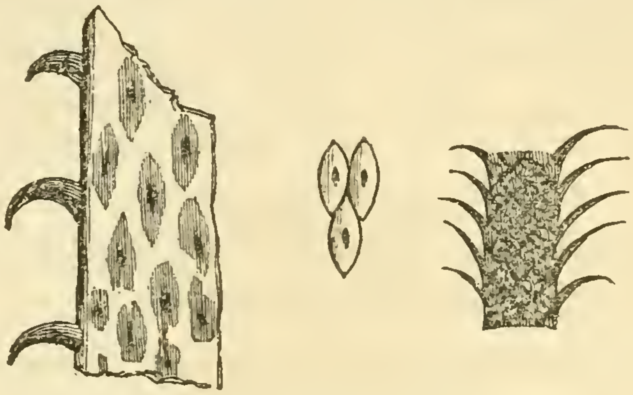

Fig. 3 *a* Fig. 3 *b* Fig. 3 *c*

Fig. 3. *Lepidodendron Gaspianum.* *a*, decorticated stem and leaves; *b*, areoles; *c*, small branch and leaves.

accompanied by the leaves. In specimens about two inches in diameter, the areoles are two lines in length and one in breadth, and placed closely together. They are elliptical, acuminate, with central leaf-scar, the form and markings of which could not be perceived. The leaves are thick at the base and short, slightly ascending, and then curving downward. The branches are slender, straight, and very uniform in thickness in the portions observed. This plant may be identical with the *L. Chemungense* of Hall, from the Devonian rocks of New York; but I am not aware that any specimens of that species hitherto observed show the leaf-scars or leaves; and, when these are obtained, should the present species prove distinct, I would name it *L. Gaspianum*†. Its characters, as above stated, are represented in figs. 3 *a–c*.

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* It is possible that some of the fragments, from the Devonian of the Thüringerwald, included by Prof. Unger in his order *Rhachiopterideæ* may be allied to *Psilophyton.* (See Denkschr. Kais. Akad. Wissen. Wien, vol. xi. p. 139.)

† *L.* (*Sagenaria*) *Veltheimianum*, another ancient and widely distributed species, resembles the above in the form of the areoles and position of the scars; but the leaves and young branches differ, and my specimens show no median furrow in the areoles. *L. nothum* (Unger) also seems closely allied.

3. PROTOTAXITES, gen. nov. (Fig. 4.)

Woody trunks with concentric rings of growth and medullary rays. Cells of pleurenchyma scarcely in regular series, thick-walled, and cylindrical, with a double series of spiral fibres. Disc-structure indistinct in the specimens observed.

I propose the above generic appellation for a tree having the spirally marked cells characteristic of the genera *Taxites* and *Spiropitys* of Gœppert, but differing from any conifer known to me in the cylindrical form and loose aggregation of the wood-cells, as seen in the cross-section, in which particular it more

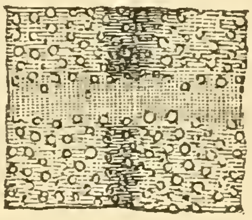

Fig. 4 *a*

Fig. 5 *b*

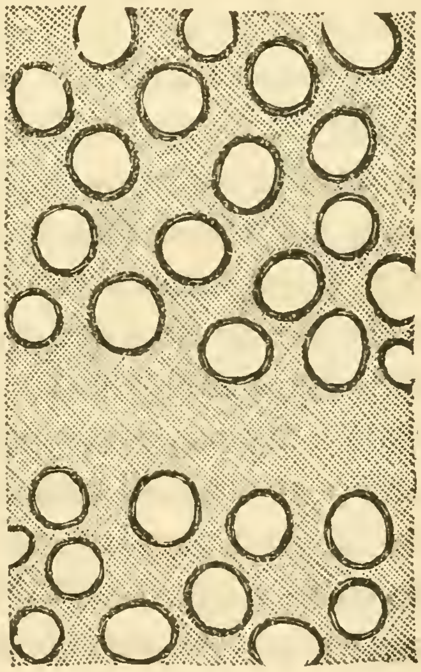

Fig. 5 *c*

Fig. 4. *Prototaxites Logani.* *a*, cross-section, magnified 40 diams., showing growth-line and medullary ray ; *b*, longitudinal section (300 diams.) ; *c*, transverse section (300 diams.)

nearly resembles the young succulent twigs of some modern conifers than their mature wood. A fine silicified trunk of this tree was brought from Gaspé by Sir W. E. Logan, and was shortly described in the 'Proceedings of the American Association' for 1856.

The specimen is nine inches in diameter, and presents throughout a series of rings of growth, rather more than one-tenth of an inch in average thickness. Under the microscope, the cross-section exibits cells perfectly circular in outline, not crowded, but becoming much smaller at the margins of the rings of growth, where some large irregular openings perhaps represent resin-ducts. The medullary rays are marked by clear structureless spaces. In the longitudinal section, parallel to the medullary rays, the wood-cells are seen to be much elongated, and to terminate in conical points; and their sides are covered with the remains of a double series of spiral fibres, among which are a few scattered roundish spots, which perhaps indicate a single row of discs*. The cells of the medullary rays have been entirely disorganized; but the space which represents them in a tangential slice, shows that they must have consisted of several rows of cells. (Figs. 4 *a–c.*)

In my late visit to Gaspé, I was so fortunate as to find a second tree of this species imbedded in the strata, though having its structure in a less perfect state of preservation than the specimen above described. It was in a prostrate position, the trunk lying S. W. and N. E., in a thinly bedded, crumbling, pyritous sandstone. The trunk is silicified, one foot five inches in its greatest diameter, and eleven inches in its least, the difference being due to compression; a branch five inches in diameter sprang from its side. On the external surface was a thin layer of crumbling coal, probably representing the bark. No pith was perceptible; but there was a channel or depression along the upper surface, as if a pith-cavity had existed and, when the wood became softened by decay, had given way to pressure. The age of this tree, as indicated by its rings of growth, would be about one hundred and fifty years; so that, though the tissue appears lax, it was not of more rapid growth than in modern conifers. The growth-rings also in the specimen previously described, as well as in this, are well marked, indicating a decided difference of temperature in the seasons of the Devonian year. I cannot propose for this monarch of the old Devonian forests of Gaspé a better or more appropriate name than that of its discoverer, and shall therefore name it *Prototaxites Logani.*

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* This disc-like structure was first pointed out to me by Mr. Poe, of Montreal, a very zealous and successful microscopist.

With respect to the affinities of the genus, I can only say that the markings on its wood-cells most nearly resemble those of the two genera of fossil Taxine trees above-mentioned, which are, however, found in much more modern geological formations. Among recent trees known to me by specimens or figures of their tissues, *Taxus baccata* and *Torreya taxifolia* most nearly resemble the Gaspé fossil. In the meantime, therefore, it may be included in the subfamily *Taxineæ*.

I could detect no leaves or fruit likely to belong to the species; but this is not wonderful, since in the Coal-formation the wood of conifers is very abundant, while their foliage is extremely rare.

Before leaving this ancient taxine conifer, it may be useful to notice the deceptive appearances which its wood presents when imperfectly preserved. In some parts of my second specimen the woody tissue has been entirely obliterated, and is replaced by a kind of oolitic concretionary structure, apparently connected with the presence of iron-pyrites. In other portions the wood seems to have been resolved into a homogeneous paste before silicification; and this, being moulded on minute granular crystals of quartz, assumes the aspect of a tissue of fine parenchymatous cells—a deceptive appearance very common in badly preserved fossils penetrated by calcareous or silicious matter. In other parts of the specimen the cell-walls remain, but in an opaque coaly condition, which conceals their spiral fibres and discs. I am not quite certain that this last form may not represent the natural state of the heart-wood of the tree. In the first specimen, obtained by Sir W. E. Logan, the whole trunk appears to be well preserved, with the exception of the medullary rays.

4. Poacites, Knorria (fig. 5), Carbonized Wood (fig. 6), etc.

In addition to the plants above described, the Gaspé sections contain, especially in the beds near the coal-seam, abundance of what seem to be long parallel-sided leaves, with delicate longitudinal striæ, and varying from a fourth of an inch to an inch, in breadth. They may be placed provisionally in the genus *Poacites*, but are perhaps leaves of *Nœggerathia* or *Cordaites*.

Fig. 5 *a*

Fig. 5 *b*

Fig. 5. *Knorria ?* *a*, nat. size; *b*, magnified.

There is also in the Collection of the Geological Survey of Canada a remarkable fragment, covered with sharp, flat, angular scales. Were it not for its carbonaceous character, I should be inclined

to regard it as of animal rather than vegetable origin. If a plant, it must, I presume, be referred to the genus *Knorria* (see fig. 5). In the same collection is a flattened and obscurely marked stem, from rocks of the same age at Kettle Point, Lake Huron. Its markings are scarcely sufficiently distinct for description, but cannot be distinguished from those of some of the varieties of *Knorria imbricata.*

Another suite of specimens in the Museum of the Geological Survey indicates the existence of a large plant, the precise nature of which it is perhaps at present impossible to determine. One of the specimens from Gaspé has the aspect of a long flattened trunk, having in a few places the remains of a carbonaceous coating, presenting longitudinal ribs like those of *Calamites.* It is crossed at intervals by markings not quite at right angles to the sides of the stem, each of which consists of a sharp ridge with a furrow at either side. The specimen is four inches in breadth and about four feet in length. Other specimens from Kettle Point vary from five inches to one inch in breadth; and some of them show traces of longitudinal ribs, but others are quite smooth, or marked only by the rhombic structure-lines of the coaly matter. All show transverse or diagonal ridges, though some of these seem to be merely cracks filled with mineral matter. Crushed Calamites, in a very bad state of preservation, might assume these appearances; but, until better specimens occur, the true nature of these plants must remain doubtful. They are very possibly of the same nature with the Calamite-like stems described by Miller in his 'Testimony of the Rocks,' p. 439.

In every part of the Gaspé sections, beds occur having their surfaces thickly covered with fragments of carbonized vegetable matter, evidently drifted by the currents which deposited the sand composing the beds. A large proportion of these comminuted plants belong to the genus *Psilophyton*; but many are fragments of the wood of larger vegetables. Nearly all are in a very imperfect state of preservation; and most of those that retain their structure show a scalariform tissue similar to that represented in fig. 6, and probably belong to the axis of *Lepidodendron.* Others exhibit elongated woody cells, without minute markings, perhaps

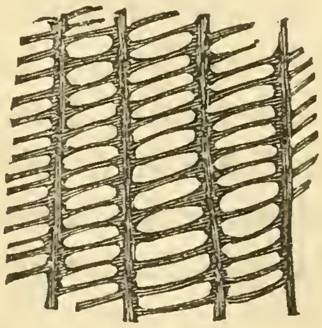

Fig. 6.

Fig. 6. Scalariform tissue (magnified 300 diams.)

from the cortical portion of the same genus, or possibly coniferous*. Another form of carbonaceous matter, abundant in some of the sandstones, consists of scaly fragments resembling the remains of decayed cones, probably *Lepidostrobi.*

The great abundance of vegetable fragments throughout an immense thickness of rock, indicates the existence of extensive land surfaces clothed with vegetation, though this apparently consisted of but a few species. The small bed of coal occurring in the lower part of the section, is composed entirely of irregularly laminated shining coaly matter without mineral charcoal. From its appearance and the vegetable remains in its underclay, I infer that it consists principally of the accumulated rhizomata of *Psilophyton, in situ.* Its roof-shale is filled with the Poacites-like leaves before mentioned, and with stems of *Psilophyton;* and it is remarkable that these last are in great part coiled up in the state of vernation, as if overwhelmed by a succession of spring floods.

5. Animal Remains, Rain-marks, etc.

The animal remains found in the plant-beds were *Entomostraca* (*Beyrichia*), *Spirorbis* (resembling that of the coal-measures), Worm-tracks, and Ichthyodorulites (*Onchus* and *Machæracanthus*†). In one of the beds above the coal Sir W. E. Logan found a few brachiopodous shells, apparently identical with those at the base of the series, and also some remarkable transversely marked furrows, which may have been produced by worms or by marine gasteropods.

Near the upper part of the section, where the plants become more rare, and the rocks are more abundantly tinged with the red peroxide of iron, the beds are plentifully and often very grotesquely marked with ripple-furrows, shrinkage-cracks, and current-lines. In one or two beds there are surfaces covered with rounded projections resembling casts of rain-marks; and in proof that this is their true character, the surface being irregular, we have not only the rain-marks themselves, but the little rills formed by the gathering drops as they rolled along, in this one of the most ancient showers of which we have as yet any geological record.

The general character of the conditions indicated by the Devonian rocks and flora of Gaspé does not differ materially from that

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* *Aporoxylon* (Unger).

† Prof. Newberry regards one of these as identical with his *Machæracanthus sulcatus* from the Devonian of Ohio.

of the Carboniferous period, though the vegetation would appear to have been poorer in species and more exclusively Lycopodiaceous; in which respects it more nearly resembles that of the Lower than of the Middle or Upper Coal-measures. The general history is that of a sea-bottom elevated or filled up in such a manner as to afford sandy or muddy flats, on portions of which plants grew, and on other portions vegetable fragments were drifted, or bare surfaces were exposed to the alternate influences of aqueous deposition and aërial desiccation,—these various conditions being more or less prevalent throughout a long period, during which the area may have been gradually sinking, to be again disturbed and elevated at the commencement of the Carboniferous period.

In explanation of the siliceous and plant-bearing character of the Gaspé beds, as compared with their more calcareous and marine character in some other parts of America, I may point to their vicinity to the old Laurentian land on the north side of the Gulf of St. Lawrence, and to the possible existence of a nearer belt of Lower Silurian land, indicated by the unconformability, in this part of Canada, of the Lower and Upper Silurian rocks.

In the collection of Sir W. E. Logan there are some vegetable remains from the limestones of Cape Gaspé and its vicinity, which perhaps indicate a still older terrestrial flora than that above described. They afford, I think, evidence of the existence of at least one species of *Psilophyton* and one of *Nœggerathia* or *Poacites;* but whether identical or not with those above described, I cannot determine from the specimens. The beds in which they occur certainly underlie the Gaspé sandstones, and are probably Upper Silurian.

ARTICLE II.—*List of Plants found growing as indigenous in the neighbourhood of Prescott, C. W.; for the most part, collected in* 1859, by W. E. BILLINGS. (Supplementary to Article 6, "Canadian Naturalist," February, 1858.)

Ranunculaceæ.

Anemone cylindrica, (Gray). Thickets; westward; common.
Hepatica triloba, (Chaix). Exposed rocky places; rare.
Ranunculus aquatilis (L.), var. divaricatus. Ponds, &c.; common.
" Pursbii, (Richards). Railroad Bay; rare, but common northward.

Ranunculus flammula (L.), var. reptans. Ordnance lots, near Fort Wellington; on heavy soil, in exsiccated places; not frequent.

" Pennsylvanicus (L.) Flowering, August and November. Everywhere common in moist places.

Actæa spicata (L.), var. rubra. (Michx). Woods and thickets, affecting more exposed localities than var. alba.

Nymphæaceæ.

Nuphar advena, (Ait.) Everywhere common in still water.

" Kalmiana, (Pursh). Nation River, and common northward.

Fumariaceæ.

Corydalis glauca, (Pursh). Gneiss rocks, near Brockville; rare.

Cruciferæ.

Nasturtium lacustre, (Gray). Growing in crevices of rocks in shallow, running water; rare.

Cardamine hirsuta, (L.) Wet places; common, especially in shady swamps.

Sinapis nigra, (L.) In places where it was formerly cultivated.

Lepidium Virginicum, (L.) Waste, exposed, hard soil; very common.

Thlaspi arvense, (L.) West end of Dibble Street; rare.

Violaceæ.

Viola Canadensis, (L.) Rich woods, westward.

Cistaceæ.

Lechea minor, (Lam.) Banks of the St. Lawrence, westward.

Droseraceæ.

Drosera rotundifolia, (L.) Marsh near Prescott Junction; rare.

Hypericaceæ.

Hypericum mutilum, (L.) In wet, sandy places; common.

Caryophyllaceæ.

Arenaria serpyllifolia, (L.) A weed, in gardens and elsewhere; common.

Stellaria borealis, (Bigelow). Swamps northward.

Geraniáceæ.

Geranium Robertianum, (L.) Banks of Conway's Creeks, among loose rocks.

Rutaceæ.

Zanthoxylum Americanum, (Mill.) Woods westward; not frequent, but abundant northward and southward.

Anacardiaceæ.

Rhus Toxicodendron, (L.) In swamps and thickets; common.

" glabra, (L.) Northward in woods, and not often met with.

Leguminosæ.

Trifolium arvense, (L.) Conway's; not seen elsewhere.

Desmodium Canadense, (D. C.) Banks of the St. Lawrence, in thickets; rare.

Astragalus Canadensis, (L.) Wastes near Grand Trunk Railway gravel pit. Common on the rocky banks of the St. Lawrence near Brockville.

Lespedeza capitata, (Michx). Same localities as last, and more abundant.

Vicia sativa, (L.) Waste places; rare.

Lathyrus palustris, (L.), variety myrtifolius. Shaded banks along streams; rare.

Apios tuberosa, (Mœnch). Marsh near Blue Church, and common on the banks of streams inland.

Amphicarpæa, (Nutt.) Wood and thickets; abundant.

Rosaceæ.

Potentilla Canadensis, (L.) Dry, grassy places, but not common.

Rubus hispidus, (L.) Low woods; rare, but common northward.

Rosa blanda, (Ait.) Waste places; common, especially among rocks.

Cratægus Oxycantha, (L.) Rocky banks of the St. Lawrence, near Brockville.

Pyrus Americana, (D. C.) Wet woods, four miles north of Prescott.

Onagraceæ.

Epilobium palustre, (L.), var. lineare. Swamps and bogs; common.

Proserpinaca palustris, (L.) Swamps northward.

Hippuris vulgaris, (L.) In shallow water, near the banks of the St. Lawrence, Johnstown.

Grossulaceæ.

Ribes hirtellum, (Michx). Common in moist places.)

" lacustre, (Poir). Close, moist woods; common.

Crassulaceæ.

Sedum Telephium, (L.) Waste places; rare.

Saxifragaceæ.

Saxifraga Virginiensis, (Michx). Rocky banks of the St. Lawrence, westward; abundant.

" Pennsylvanica? (L.) Bog near Graveyard; not in flower.

Umbelliferæ.

Hydrocotyle Americana, (L.) Moist places; abundant.

Heracleum lanatum, (Michx). Waste places; banks of St. Lawrence westward.

Zizia integerrima, (D. C.) Sandy banks facing southward.

Araliaceæ.

Aralia hispida, (Michx). Sandy hill-sides; not common.

Cornaceæ.

Cornus circinata, (L'Her.) Rocky banks of the St. Lawrence, westward.

" sericea, (L.) Same locality as last.

" paniculata, (L'Her.) Grand Trunk Railway enclosures; westward.

Caprifoliaceæ.

Symphoricarpus occidentalis, (R. Br.) Rocky woods, near G. T. R. gravel-pit.

Viburnum opulus, (L.) Rare, but common on banks of streams northward.

Triosteum perfoliatum, (L.) May be looked for here, as it occurs on the banks of the Oswegatchie, three miles south of Prescott.

Rubiaceæ.

Galium lanceolatum, (Torr.), G. latifolium of former Art. Common in rich woods.

Dipsaceæ.

Scabiosa atropurpurea, (L.) Grassy bank of Railroad Bay, probably escaped from cultivation.

Compositæ.

Diplopappus umbellatus, (Torr. & Gr.) Thickets westward; rare.

Solidago squarrosa, (Muhl). Rocks, banks of the St. Lawrence. westward; rare.

" latifolia, (L.), S. Muhlenbergii of former Art. Common in shady places.

Rudbeckia laciniata, (L.) Grove near the Blue Church, and westward on the banks of the St. Lawrence; rather rare.

Bidens frondosa, (L.) Everywhere; common.

" Beckii, (L.) Railroad Bay, and streams northward, but rare.

Tanacetum vulgare, (L.) Waste places near dwellings.

Lobeliaceæ.

Lobelia syphilitica, (L.) Low grounds; not common.

" Kalmii, (L.) Banks of St. Lawrence westward, in damp soil

Ericaceæ.

Vaccinium Pennsylvanicum, (Lam.) Dry thickets and woods; frequent.

" Canadense, (Kalm). Moist woods and thickets; frequent.

" Corymbosum, (L.) Swamps northward; common.

Arctostaphylos Uva-ursi, (Spreng). Rocky banks of the St. Lawrence near Brockville.

Ledum latifolium, (L.) Marsh near the Junction.

Plantaginaceæ.

Plantago lanceolata, (L.) Fields; rare.

Lentibulaceæ.

Urticularia vulgaris, (L.) Abundant in Conway's Creek.

Scrophulariaceæ.

Ilysanthes gratioloides, (Benth). Marsh near the Junction.

Melampyrum Americanum, (Michx). Rocks, woods westward; abundant.

Labiatæ.

Mentha viridis, (L.) Wet places; not common.

Hedeoma pulegioides, (Pers.) Road-sides; very rare.

Monarda fistulosa, (L.) Banks of St. Lawrence westward.

Borraginaceæ.

Lithospermum arvense, (L.) Cultivated fields; rare.

Hydrophyllaceæ.

Hydrophyllum Virginicum, (L.) Rich woods, westward; rare.

Convolvulaceæ.

Convolvulus arvensis, (L.) Banks of the St. Lawrence, westward; rare.

Gentianaceæ.

Gentiana Andrewsii, (Griset). Moist thickets, northward; rare.

Menyanthes trifoliata, (L.) Marshes and swamps, northward; abundant.

Apocynaceæ.

Apocynum cannabinum, (L.) Sandy hill-sides, northward; rare.

Chenopodiaceæ.

Chenopodium hybridum, (L.) Very common.

" Botrys, (L.) Near Grand Trunk Station; rare.

Polygonaceæ.

Polygonum Pennsylvanicum, (L.) Exposed, waste places; common.

" hydropiperoides, (Michx). Nation river, in water; common.

" tenne, (Michx). Banks of the St. Lawrence, westward.

Fagopyrum esculentum, (Mœnch). Woods and fields, frequent.

Elæagnaceæ.

Shepherdia Canadensis, (Nutt.) Rocky banks of the St. Lawrence westward.

Ceratophyllaceæ.

Ceratophyllum demersum, (L.) St. Lawrence River, and Conway's Bay; very common.

Callitrichaceæ.

Callitriche verna, (L.) Ponds and small streams; rare.

" autumnalis, (L.) St. Lawrence, in shallow water; abundant.

Euphorbiaceæ.

Euphorbia maculata, (L.) Railway tracks, and hard soil in open places; rare.

" obtusata, (Pursh). Road-sides and waste places; very common.

Acalyphya Caroliniana, (Walt.) Similar situations as last, but rare.

Myricaceæ.

Myrica Gale, (L.) Rocky banks of the St. Lawrence, near Brockville; rare.

Comptonia asplenifolia, (Ait.) Woods and wastes near G. T. R'way gravel-pit; abundant.

Betulaceæ.

Betula alba, var. populifolia, (Spach). Rocky banks of the St. Lawrence, near Brockville.

Salicaceæ.

Salix candida (Willd). Marshes, and moist open places; common.

" longifolia, (Muhl). Very common.

" nigra, (Marshall). Rare, but large; one tree, about half a mile west of the town, in a swamp, measures seven feet at five feet from the roots.

Coniferæ.

Pinus rigida, (Miller). Rocky banks of the St. Lawrence, near Brockville.

Juniperus communis, (L.) Abundant, on the banks of the St. Lawrence, near Brockville.

Araceæ.

Arisæma triphyllum, (Torr.) Moist woods; very common.

Acorus Calamus, (L.) Margin of streams, in slow-running water common.

Typhaceæ.

Sparganum angustifolium? (Michx). Marshy places; common.

Lemnaceæ.

Lemna trisulca, (L.) Conway's Creek, and in ponds and streams in sluggish water, northward; abundant.

" minor, (L.) Upon the surface of stagnant water, in great abundance.

Naidaceæ.

Naias flexilis, (Rostk). Slow-running water of rivulets, northward.

Zannichella, palustris, (L.) Railroad Bay; not seen elsewhere.

Potamogeton pectinatus, (L.) St. Lawrence; very common.

" pusillus, (L.) Ponds, in clear water; common.

" compressus, (Lex Fries). Grows with the last.

" perfoliatus, (L.) St. Lawrence River, and in ponds, common.

" lucens, (L.) Nation River, in great abundance.

" natans, (L.) Railroad Bays.

" heterophyllus, (L.) "

Alismaceæ.

Scheuchzeria palustris, (L.) Close swamps and bogs northward, rather rare.

Hydrocharidaceæ.

Anacharis Canadensis, (Planchon). Ponds and sheltered bays of the St. Lawrence; very common.

Valisneria spiralis, (L.) In similar situations as last, but deeper water, and not as common.

Orchidaceæ.

Platanthera bracteata, (Torr.) Close, damp woods; not common.

" hyperborea, (Lindl.) " " "

" psycodes, (Gray). Open, moist places.

Calopogon pulchellus, (R. Brown). Bogs northward; rare.

Liparis Lœselii, (Richard). Open places; rare.

Aplectrum hyemale, (Nutt.) Rich, moist woods, westward; rare.

Liliaceæ.

Smilacina stellata, (Desf.) Rich, moist woods; rather rare.

Melanthaceæ.

Uvularia sessilifolia, (L.) Low, moist places, in woods.

Juncaceæ.

Luzula pilosa, (Willd). Pine grove, near Blue Church; not found elsewhere.

Pontederiaceæ.

Schollera graminea, (Wild). Railroad Bay, growing with Potomogeton.

Cyperaceæ.

Cyperus diandrus, (Torr.) Low grounds; common. C. inflexus of former list.

strigosus, (L.) Banks of the St. Lawrence, westward; rare.

Eleocharis compressa, (Sullivant). Wet places; common.
" acicularis, (R. Brown). " "
Scirpus pungens, (Vahl). St. Lawrence, westward; rare.
" sylvaticus, (L.) Wet places; common.
Eriophorum polystrachyon, (L.) In bogs, and everywhere common
Carex polytrichoides, (Muhl.) Bogs; common.
" Sartwellii, (Dew.) Grassy, wet places, northward; rare.
" teretiuscula, (Good.) Moist places; very common.
" stipata, (Muhl.) Common.
" sparganioides, (Muhl.) Woods and fields, in moist places; common.
" rosea, (Schk.) " " " common.
" chordorhiza, (Ehrh.) Grassy marshes; common.
" trisperma, (Dew.) Woods and swamps; "
" tenuiflora, (Wahl.) " " "
" canescens, (L.) Wet, open places.
" Deweyana, (Schw.) Copses; rare.
" stellulata, (Good). Abundant in wet places, presenting a variety of forms.
" sychnocephala, (Carey). The few plants I have seen of this species were growing in somewhat dry localities.
" scoparia, (Schk.) Wet places; very common.
" lagopoioides, (Schk.) With the last, and equally common.
" adusta, (Boott). Wastes, and along fences; "
" festucacea, (Schk.) With the last; common.
" stricta, (Lam.) Swamps and ditches; "
" aquatilis, (Wahl.) Conway's Creek, growing in water.
" crinita, (Lam.) Swamps and ditches; common.
" aurea, (Nutt.) Grassy fields; rare.
" Crawei, (Dew.) Field near Fort Wellington; not seen elsewhere.
" granularis, (Muhl.) Fields and waste places; very common.
" gracillima, (Schw.) Fields and woods, in moist places; common.
" plantaginea, (Lam.) Moist woods; rare.
" laxiflora, (laxiflora). Woods and fields, in moist places; common.
" pedunculata, (Muhl.) Rich, rocky woods, westward; abundant; flowering in April.
" Pennsylvanica, (Lam.) Same locality as last, and in full flower 8th May. Abundant.
" varia, (Muhl.) Dry wood; not so common as last.
" pubescens, (Muhl.) Woods; rather rare.
" arctata, (Boott). Woods and thickets; common.
" Œderi, (Ehrh.) Barren field near Fort Wellington; not common.
" filiformis, (L.) Marshes, northward; not frequent.
" lanuginosa, (Michx). Growing with the last, but not common.
" aristata, (Michx). Ponds, and along ditches holding water; common.
" comosa, (R. Brown). " " " " common.
" Pseudo-Cyperus, (L.) " " " "

Carex lupulina, (Muhl.) Wet places; common. About the latest flowering of the Carices.

" retrorsa, (Schw.) Conway's Creek. Spikes sometimes profusely branched.

Gramineæ.

Alopecurus aristulatus, (Michx). Wet places, growing in water; common.

Agrostis scabra, (Willd). Exsiccated places; very common.

Cinna arundinacea, (L.) Damp woods and thickets; common northward.

Muhlenbergia glomerata, (Trin.) Marsh near the Junction; rare.

" Mexicana, (Trin.) Wastes near the Junction; rare.

Brachyelytrum aristatum, (Beauv.) Woods; common.

Calamagrostis Canadensis, (Beauv.) Swamps and marshes generally, growing in water; common.

Poa annua, (L.) Roadside and waste places; frequent, and flowering from May to November.

Festuca nutans, (Willd). Rich woods, westward.

Bromus ciliatus, (L.) Banks of the St. Lawrence, westward; rather rare.

Phragmites communis, (Trin.) Swamp north of Junction; rare.

Elymus Virginicus, (L.) Banks of streams; rare.

" Canadensis, (L.) With the last, or in similar localities.

Aira flexuosa, (L.) Grove north of Capt. Miller's; rare.

Millium effusum, (L.) Close, damp woods; common.

Panicum glabrum, (Gandin). Sandy fields, eastward; common.

" clandestinum, (Muhl.) Waste places; common.

" xanthophysum, (Gray). Dry, sandy soil; common.

Andropogon furcatus, (Muhl.) Banks of the St. Lawrence, westward.

Sorghum nutans, (Gray). Banks of the St. Lawrence, near Brockville.

Equisetaceæ.

Equisetum limosum, (L.) Conway's Creek and elsewhere, growing in water; common.

Filices.

Polypodium vulgare, (L.) Rocky woods, westward; rare, but abundant on gneiss rocks, near Brockville.

" hexagonopterum, (Michx). Rich woods, westward; rare.

" Phegopteris, (L.) Woods, northward; rare.

Struthiopteris Germanica, (Willd.) Damp, rich soil, in shades; common.

Woodsia Ilvensis, (R. Brown). Rocks, near Brockvile.

Botrychium lunarioides, (Swartz). Mossy banks, in woods and fields; rare.

Lycopodiaceæ.

Lycopodium complanatum, (L.) Banks of the St. Lawrence, westward, and in an exposed situation.

Selaginella rupestris, (Spreng). Pine grove, westward, upon rocks; abundant upon rocks near Brockville.

Musci.

Sphagnum cymbifolium, (Dill.) Bogs and swamps; common.
" cyclophyllum, (Sulliv. & Lesqx.) Moist, open places; rather rare.
Dicranium varium, (Hedw.) Banks; very common.
" heteromallum, (Hedw.) On the ground, in most places very common.
" scoparium, (L.), var. pallidum. On the ground and decayed wood; common.
Ceratodon purpureus, (Brid.) On the ground; very common.
Fissidens polypodioides, (Hedw.) Woods, westward; growing on thin stratum of veegtable mould on boulders.
Trichostomum pallidum, (Hedw.) On the ground; common.
Barbula unguiculata, (Hedw.) Near Railroad Bay, and clay soils; frequent.
Orthotrichum strangulatum, (Beauv.) Bark of Ash and other trees; common.
" affine, (Schwart.) Rocks, and sometimes trees; common.
" leiocarpum, (Br. & Sch.) Trees; rare.
" Ludwigii, (Schwægr.) " "
" crispum, (Hedw.) Trees, very common, especially on the Beech.
Schistidium apocarpum, (Br. & Sch.) On boulders; common.
Hedgwigia ciliata, (Ehrh.) " "
Diphyscium foliosum, (Web. & Mohr.) On the ground, in woods.
Atrichum angustatum, (Beauv.) In woods; very common.
Polytrichum commune, (L.) Shady, moist places; very common.
Bryum argenteum, (L.) Exposed, hard soil, rocks, &c.; common.
Mnium cuspidatum, (Hedw.) Woods; common.
Anomodon obtusifolius, (Br. & Sch.) Trunks of trees, in moist woods; common.
Leskea rostrata, (Hedw.) Base of trees; common.
Neckera pennata, " Trees; very common.
Hypnum scitum, (Beauv.) Base of trees; common.
" splendens, (Hedw.) On the ground, in woods; abundant.
" deplanatum, (W. P. Sch.) Dry woods, at the base of trees; rare.
" albulum, (C. Mull.) Moist woods, on logs, &c.; common.
" Schreberi, (Willd). On the ground, in woods; common.
" fluitans, (L.) Swamps, in water; common.
" Crista-Castrensis, (L.) On the ground, and much-decayed wood; common.
" imponens, (Hedw.) On the ground, and decayed logs; very common.
" salebrosum, (Hoffm.) " " " "

Hepaticæ.

Fegatella conica, (Corda). Damp woods, on the ground and decayed logs; common.

Scapania nemorosa, (Nees). With moss, in moist places, on banks; rare.

Frullania Virginia, (Lehm.) On trees; very common.

Radula complanata, (Dumortier). On trees; "

Philidium ciliare, (Nees). On rotten wood, in swamps; common.

Trichocolea Tomentella, " On the ground, in moist places; rare.

Mastigobryum trilobatum, " " " " common.

Lichenes.

Usnea barbata, (Fr.), [Beard Moss]. Trees, rails, &c.; common.

Evernea jubata, " " Rails, stones and trees, especially the Pine; common.

Ramalina calicaris, (Fr.), [Beard Moss]. Trees, rails, &c.; common.

Cetraria ciliaris, (Ach.) Trees and rails; rare.

Peltigera aphthosa,(Hoffm.) Moist places, on the earth, among mosses common.

" rufescens, " Moist place s, on the earth, decayed wood common.

Stricta scrobiculata, (Ach.) Trees; not common.

" pulmonaria, " Trees, especially the Maple; very com.

Parmelia crinita, " Trees; common.

" tiliacea, " " "

" lævigata, " " "

" colpodes, " " "

" conspersa, " Rocks and stones; common.

" parietina, (Fr.) Trees, &c.; common.

" stellaris, (Wallr.) Trees and stones; common.

" pallescens, (Fr.) Trees, &c.; very common.

" subfusca, " " " "

" varia, " " " "

Stereocaulon tomentosum, " On the earth and stones, in fields; com.

Cladonia pyxidata, " On the earth, rotten wood, &c.; "

" gracilis, " " " common.

" cornucopioides, " " " "

" Floerkiana, " On the earth, decayed logs, &c.; rare.

" rangiferina, (Hoffm.) On the earth, and much-decayed wood; common.

Biatora ocrophæa, (Tuckerm.) Trees; common.

Lecidea enterolenca, (Fr.) " "

Opegrapha scripta, (Ach. Schær.) Bark of trees; common.

Pertusaria purtusa, (Ach.) " " very common.

" faginea, " Trees, rocks, &c.; common.

Verrucaria epidermidis; (Fr.) Bark of trees, especially the Beech; common.

Characeæ.

Chara vulgaris. Common in bays and shoals of the St. Lawrence, in slow or stagnant water.

In this and the article above referred to, nearly all the Phenogamous plants in the neighborhood are enumerated, with the exception of a few Salices and Carices, the characters of which are too variable or obscure for me to determine them with confidence. No attempt has been made to give anything like a complete list of our Cryptogamia; and, little else than the more common forms are noticed.

ARTICLE III.—*On the Tubicolous Marine Worms of the Gulf of St. Lawrence, by* J. W. DAWSON, LL.D., F.G.S.

Read before the Natural History Society of Montreal.

The legions of marine worms that haunt the borders of the sea are not usually very attractive to amateurs, nor have they received the attention that they merit from naturalists, yet there are few of the humbler animals that are more remarkable or interesting in their structure and habits. They constitute two orders, the errantia or vagrant sea worms, and the tubicolæ or tube dwellers. The former are the sea centipedes, sea mice, lobworms, mud worms, &c.; and though some of them are hideous in general aspect, they are all remarkable for the singular structure of their locomotive and respiratory apparatus, as well as for many curious points in their modes of life and reproduction. The report presented by Dr. Williamson to the British Association in 1851, on these creatures, is one of the most interesting zoological monographs that we possess.

The tube dwellers are simpler in the structure of their external appendages, though these are still very curious, and they are more sedentary in their habits; but their colour is often brilliant, and their shells, though generally inferior in beauty to those of the mollusks, are elegant in form, and have the advantage of being capable of easy preservation as permanent specimens.

The tubicolous worms constitute several well marked genera. Some, the *Amphitrites* and *Sabellæ*, construct fragile tubes of agglutinated grains of sand, others, the *Terebellæ*, are more select, and gather around them a tube of minute shells and shelly fragments cemented together, so that each of them is in his way a sort of little conchologist. Others secrete hard calcareous tubes, which may, as in the *Serpulæ*, be straight or irregularly curved, or, as in the *Spirorbes*, rolled into a regular spiral.

Genus *Spirorbis.*

A stroller by the sea side, searching for shells or algæ, is sure to meet with Sea weeds more or less thickly covered with little white shells, coiled up and attached firmly by one side to the weed. Sometimes they are so abundant that large fronds may have as many as a hundred on a square inch. If taken out of the sea while alive, and examined under a microscope, there may be seen to extend from the mouths of their tubes little conical buttons mounted on stalks, which are the stoppers or lids that close the orifices of their dwellings. These are followed by a group of little filaments, the gills of the animal, and amidst them is the simple suctorial mouth. These organs are slowly extended, but very rapidly withdrawn when the animal is alarmed by any agitation of the water or the vessel in which it is contained. If the animal is extracted from its tube it will be found to be a little jointed worm terminating in a point, and having at its sides minute hooks and bristles for enabling it to hold fast by the sides of its habitation and to ascend and descend at pleasure.

The species most commonly found on the shores of the gulf of St. Lawrence is the *Spirorbis spirillum—Serpula spirillum* of Linnæus. It is regularly spiral, with smooth rounded whorls, not enlarging rapidly nor much flattened at the lower side, but sometimes rising nearly into an erect position toward the mouth. Its favourite residence is on the fuci in shallow water. It is found on both sides of the Atlantic and as far north as Greenland.

On sea weeds and zoophytes from somewhat deeper water, we may often observe another species, smaller and more delicate in texture than *S. spirillum*, coiled less closely, and in the opposite way, or from right to left when the aperture of the shell is held from the observer. This is the *Spirorbis sinistrorsa.* It is not noted by Fabricius as a Greenland shell, but is found on zoophytes at Gaspé, and abounds on sea weed in deep water off the coast of Maine. This and the previous species are the only ones that an observer who confines his attention to the sea weeds of the shore may chance to meet with; but dredging in deep water will procure the following species.

Spirorbis nautiloides, the *Serpula spirorbis* of Linnæus, is of the same size with *S. Spirillum*, but is thicker, less smooth, transversely wrinkled, and more flattened at the base, so that when removed from its attachment it appears like a shell split into two equal halves. Its whorls also are more closely united and increase

in diameter more rapidly, so that there is a deep and narrow umbilical cavity in the centre. It is found both on stones and sea weeds in deep water. This is at least what I take to be the true *Serpula spirorbis* of Linnæus and Fabricius, though more recently some confusion between this shell and *S. spirillum* seems to have arisen. It was found by Fabricius in Greenland. I have it in a collection made in Labrador by Mr. Carpenter, missionary of the Canada Foreign Missionary Society, and Dr. Gould has obtained it on the American coast. I have it also on stones from the Banks of Newfoundland.

When old, this shell forms a few semi-erect turns, so as to cover up the previous whorls and the umbilicus, and terminates in a thick and slightly expanded mouth, sometimes as much as half a line in width. So completely does the shell in this condition differ from its immature state, that but for the appearances seen in sliced or broken specimens, I should have regarded it as a distinct species. A change of a somewhat similar character, though less marked, occurs in *S. cancellata*, and is represented in the figure of that species given below. Similar changes, though with differences in details, occur in *S. vitrea* and *S. porrecta*.

Spirorbis carinata (Mont.) is a deep water species, closely allied to *S. nautiloides*, if not a variety of it. It is distinguished by a keel or ridge running along the whorls, nearer the inner than the outer edge. In some old shells a second ridge appears, and then the shell very closely resembles *S. quadrangularis* of Stimpson. Young shells, on the other hand, are not distinguishable from those of the *S. nautiloides*. This species is not noted by Fabricius as a Greenland shell. It abounds in the collections of Mr. Bell of the Geological Survey, and in my own from Gaspé, where it occurred in deep water, attached to dead shells and stones. It was found at Labrador by Mr. Carpenter. I also have it on a stone taken up from the Banks of Newfoundland by a fisherman's hook, and presented to me by A. Dickson, Esq.

Spirorbis vitrea is like *S. sinistrorsa*, a reversed species, but is thick, semi-transparent, and has the whorls closely crowded, and in adult shells turned up and somewhat narrowed and thickened at the mouth. A group of these shells looks like a number of small drops of glass that had fallen on a stone and cooled there. Fabricius discovered this species in Greenland. It occurs in Mr. Bell's Gaspé collection, on the Banks of Newfoundland, and fossil

in the Pleistocene beds at Montreal and Beauport. It is noted by Stimpson as found in the Bay of Fundy.

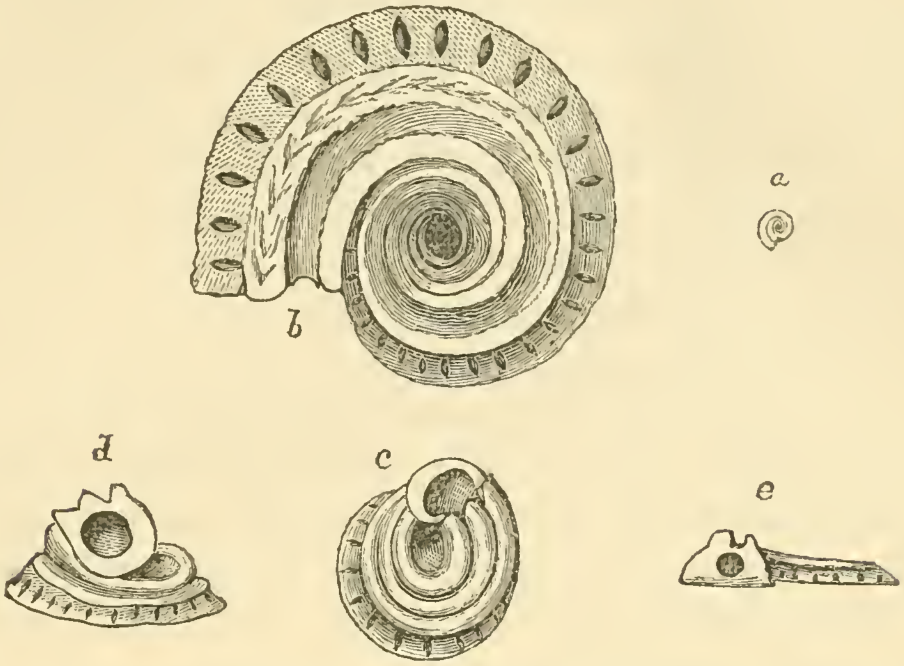

Fig. 1.—*Spirorbis cancellata.* *a* nat. size; *b* magnified; *c* older shell less magnified; *d*, *e* side views.

Spirorbis cancellata is in point of ornament the prince of our Spirorbes. It is thick, regularly spiral when young, but with the mouth tending upward when old. Above, it has two, or, in old shells, three strong ridges revolving with the whorls, and giving it an elegant fluted appearance, and the outer side presents a furrow crossed by strong transverse bars, or in other shells appears as a regular slope with a series of depressed spaces at regular intervals. The whole appearance of this shell in a perfect specimen is very elegant, and as I have not been able to find a good figure of it in any work that I have consulted, I have attempted to represent it in the figures on this page. It is a reversed species. *S. cancellata* abounds in Mr. Bell's Gaspé collection. It is one of the species found by Fabricius in Greenland and named by him, but I am not aware that it has been met with since, until dredged by Mr. Bell in about 60 fathoms on the Gaspé coast, where it lives attached to the valves of dead shells. It is also in Mr. Carpenter's collection from Labrador.

Spirorbis granulata, (Muller) resembles that last described, but wants the ornament around the margin, having only two furrow and three sharp elevated ridges on the upper side, and it is not reversed. Fabricius, who found it in Greenland, states that its animal is yellow, with a white stopper on a short stalk, and six respiratory filaments. It occurs, though rarely, in Mr. Carpenter's

collection from Labrador, on stones and bryozoa, and was found by Stimpson at Grand Manan.

Spirorbis porrecta differs from the others in having only a few spiral turns and then boldly standing erect. It is thin, shining, and round in its tube, and from its habit of growth resembles a serpula; but the animal is that of a spirorbis. Fabricius very clearly describes it as follows. It occupies when contracted only a third part of the length of the shell, is smooth, flattened on the abdomen and attenuated posteriorly. Its stopper is extended on a stem and at its base are six soft, short, white, conical respiratory processes. At the base of these the body is white, plicated, and armed with golden setæ or bristles, extending forward. The rest of the body is blood red above, lighter on the sides and below, and its colour can be seen through the semi-transparent shell. This species occurs at Gaspé on Zoophytes, and is recorded by Stimpson as found at Grand Manan.

It thus appears that of these curious little spiral worm shells, the precise use of which in nature it would perhaps be difficult to point out, but which no doubt enjoy life after their fashion, and afford food to other animals, we have no less than seven or eight species in the gulf of St. Lawrence.

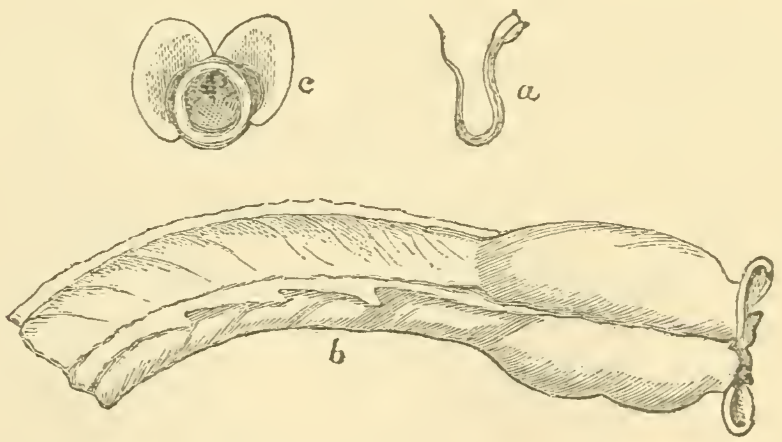

Fig. 2.—*Serpula (Vermilia) serrula?* *a* nat. size; *b* anterior part magnified; *c* aperture magnified.

Genus *Serpula*.

The true serpulæ are neither abundant nor large in the Gulf of St. Lawrence, in so far as my observation extends. The most common species, found both in Labrador and Gaspé, is of small size, about $\frac{1}{40}$th of an inch in diameter, wrinkled transversely and with a distinct and strongly denticulate keel on the back. It is adherent in its whole length, sometimes much and irregularly

bent, sometimes nearly straight. It corresponds exactly with the description of *S.* (*Vermilia*) *serrula* of Stimpson, from the Bay of Fundy. It also corresponds with the *S. triquetra* of Linnæus and Fabricius, except in its smaller size, and more delicate structure. In some specimens there is a structure which, so far as I am aware, has not been noticed in either of the above species. It consists of two lateral lobes, somewhat more than one-twentieth of an inch in length, attached to the sides of the anterior portion of the tube, and opening by narrow labiate mouths on each side of the principal orifice, so that there appear to be three orifices close together, the central one round, the lateral ones narrow and lunate. If the animal inhabiting this shell has the structure of *protula*, one may suppose that these lobes accommodate the lateral disk or expansion of the thorax. As they appear only in certain specimens, they may perhaps be connected with the function of reproduction, and be of the nature of ovi-capsules, or they may serve to enable a certain amount of respiration to proceed when the gills are retracted. It would be interesting to study the living animal with reference to these curious additions to its tube.

Serpula vermicularis is one of the shells which I have described in a former paper as found in the Pleistocene clay at Logan's Farm, but I have not seen it from the Gulf, nor is it noted by Fabricius. It is round, smooth, and tortuous.

Genus *Pectinaria.*

A shell, probably of this genus, made up of a single layer of grains of sand, is frequent on sandy shores. It is perhaps *P. Grœnlandica* Grube, *P. Belgica* Lam., but I have not seen the animal.

The *Serpula seminulum* of Fabricius is a foraminiferous shell, the *Miliolina seminulum* described in my previous papers on the Pleistocene deposits. The *S. stellaris* of Fabricius is the *Truncatulina lobata,* also a foraminiferous shell, parasitic on shells and zoophytes, found in the Gulf of St. Lawrence and in the Pleistocene beds. *Serpula contortuplicata*, a common Atlantic species, is also noted by Fabricius, but has not been found in the Gulf. This industrious observer has also, under the genera *Sabella, Nereis*, and *Tubularia*, several species of tube-dwelling worms, which are perhaps identical with species of *Sabella*, *Amphitrite*, &c., described by the naturalists of the United States, but which have not been observed in the Gulf of St. Lawrence.

The investigations recorded in the foregoing pages originated partly in the researches necessary to the study of the Pleistocene fossils of the St. Lawrence valley, and partly in the interest of the collections placed in the hands of the author by Mr. Bell and Mr. Carpenter. The most useful guide to the study of these collections has proved to be the old work of Otho Fabricius—the Fauna Grœnlandica, a wonderful monument of painstaking and accurate research, to which I hope ere long to direct the attention of Canadian naturalists in a comparative sketch of the marine fauna of Greenland, as described by Fabricius and others, and that of the Gulf of St. Lawrence and the tertiary beds on its margin. For access to this and some other scarce books, and for aid in the comparison of some doubtful species, I have to thank Dr. Gould of Boston and Mr. Stimpson.

ARTICLE IV.—*A Classified List of Marine Algæ from the Lower St. Lawrence, with an Introduction for Amateur Collectors.* By the REV. ALEX. F. KEMP.

This large and beautiful collection of Algæ, which we have here catalogued according to the most recent order of classification, has been put into our hands, for the most part, by a diligent and skillful collector (whose name we are not permitted to give), for the purpose of illustrating an interesting department of our Canadian Botany. The Lower St. Lawrence is, we believe, a field for research which has not yet been sufficiently explored. It has all the characteristics to render it the favorite habitat of a very wide range of genera and species. In the colder waters of the north shore, we may expect to find plants peculiar to the Arctic and Sub-Arctic zones, together with those that belong to the temperate shores of the world. Again, the somewhat warmer waters of the southern coast, as far east as Gaspé, with their peculiar shores and bays, will undoubtedly afford forms and species of marine plants, whose limits of geographical distribution reach far into the warmer regions of the south. Further, the junction of the fresh waters of the river with the salt waters of the gulf, will be found a favorite resort for some of the more beautiful and delicate species of Algæ. We have as yet seen no specimens from this middle region of our waters; but we have no doubt that somewhere about Grosse Isle, or on the shores of the counties L'Islet and Saguenay, a fine and as yet unexplored field lies open to some enthusiastic collector.

An idea is we fear somewhat prevalent that the collection and classification of sea-weeds is an employment only for children and idle people—that to give anything like earnest attention to this beautiful but comparatively useless class of plants, is to mis-spend one's valuable time. Now, we do not deny that this class of plants, from their rare beauty of form and colour and from the facility with which they may be prepared as articles of ornament, has become of late years a favourite source of amusement to young persons, and especially to young ladies. It is, however, certain that while they find amusement in collecting and preparing specimens, they also bring their minds into contact, in a most instructive way, with some of the most interesting and beautiful forms of Creative Wisdom. They, for example, become familiar with colours of gem-like lustre and with varieties of form and structure, which, for delicacy and beauty, far surpass the conceptions of human imagination or the skill of human hands. Especially this is the case if collectors examine and classify their specimens by the aid of a microscope, with powers ranging from 100 to 400 diameters. This will open up to them a world of wonders, and impart a deep and delicious pleasure to all their researches. Now that good microscopes are so cheap and so easily attainable, every collector of plants should have one, and should make it his constant companion. There is a large number of the Algæ, and these too the most beautiful and interesting, which can only be determined by a microscopic examination of their tissues and their modes of reproduction.

Let not any one imagine that these plants are of no use. They may, it is true, be of little use to us; but it is taking a low view of the utility of things to judge of it simply by our personal advantage. It is admitted that we can get very little to eat or to sell from the Algæ. We would not advise any one to attempt to make a living by collecting and preparing specimens. They are, nevertheless, not without their use. We get iodine, one of the most valuable of medicines, from the Fucaceæ; and the vast quantities of sea-weeds which are cast upon our shores are used extensively as a most excellent manure for our fields.

If we judge of the use of the Algæ, not by the direct benefits which we receive from them, but from the place which they occupy, and the work which they perform in the grand system of the organic kingdom, we shall see that these humble plants are entitled to most honorable consideration. If antiquity is any honor in

these days, the Algæ may say to their more lordly brethren of the woods and gardens, "Our forefathers lived many ages before the first of your tribe was born. We inhabited the shallow waters and the shores of the most ancient Silurian seas, and, in every subsequent age, for millions of years, we have borne silent testimony to the wisdom of the great Creator." Consider too, that if sea-weeds cannot to any great extent be eaten by us, that yet the tiny molluscs, the radiates and the smaller vertebrate fishes need food as well as we. These plants are the sources from which very many of them are sustained in life. Without them there would be famine in many families of the animal kingdom.

The marine plants perform, besides, the same sanitary work in the sea which the land plants perform on the land. Both are most important agents in purifying the atmosphere and preserving it in a healthy state for animal use. These apparently insignificant Algæ are indeed most busy and benevolent creatures. They swallow up much that is poisonous in the water, and labour hard to keep it pure and sweet. It is well known that the carbon arising from decaying vegetable or animal substances in water or on land, by combining with oxygen, forms carbonic acid gas, which is both very disagreeable to the organs of smell and very injurious to health. Were it not then for the provision which the good Creator has made, by means of land and sea-plants, to counteract this noxious vapour, many parts of the sea and land would be entirely unfit for the residence of animals. These marine plants have the peculiar faculty of absorbing from the carbonic acid gas all the noxious carbon, and setting free the healthy oxygen. They thus decompose that injurious compound, and render the waters suitable for animal life. In proof of this, we would adduce the fact, which those who are familiar with the sea-shore may have observed, that the Algæ are constantly covered with globules of air, which, like studs of brilliants, sparkle with great beauty, and sometimes shine like stars. These globules are the emancipated portions of oxygen, which, having been attracted into the bad society of carbon, are now set free by the benevolent action of the weeds; the result is, that, grateful for their liberty, they shine with evident joy.

We have said enough to show that the lowly Algæ are not so useless a class of plants as some people suppose, but that they fill an important place in the grand circle of creation; they, too, are evidences of that Divine wisdom which it is one of the employments of intelligent and good people to enquire into and admire. To

know their character and habits is to know the wisdom and goodness of our Father in Heaven.

Many young collectors, and admirers of these plants more mature in yéars, wish to obtain a more full acquaintance with them than that which their own unaided observations afford; but they are often at a loss to find out how this may be accomplished. Very few people in this country know anything about the scientific structure and classification of the Algæ. It is, therefore, a rare thing to find a personal instructor and guide. The next best thing is to procure good books; but then, where shall we find them? and what do they cost? are questions frequently put.

For the benefit of those who desire to cultivate, in a scientific way, this interesting department of botany, we beg to say that the books which will be of most service to them are neither difficult to obtain nor yet very costly. The best book for this country is a work by Dr. Harvey, of Dublin, recently published by the Smithsonian Institution of Washington. It can be had through any bookseller from the Messrs. Appleton, of New York, at the cost of $6. It is a large quarto size. The plates are most beautiful, and the classification most recent and complete. For a book of its kind, it is remarkably cheap. It is entitled "*Nereis Boreali-Americana.*" The next best book is Harvey's "*Atlas of British Sea-Weeds,*" with the little book which accompanies it. This work contains figures of almost every species found in the British waters, and comprises a great part of our American plants. Its cost is three guineas sterling in England, and though somewhat expensive, is really a most delightful and valuable book. "*Harvey's Manual of British Marine Algæ*" is a less costly book, and one better adapted for beginners, the last edition of which can be procured for about four dollars. A smaller and more elementary work, entitled "*Landsborough's Marine Algæ,*" very good and useful for beginners, may be obtained by any bookseller in this country, from Routledge the publisher, at a cost of two dollars. There are other books of a more expensive kind, which might be named; but these will enable any one to prosecute, with pleasure and profit, the study of the genera and species of the large subkingdom of the Marine Algæ.

The writer of this article will gladly determine any specimens for young collectors that they may find difficult or obscure. He will also be glad to receive for publication, in the *Naturalist*, any

new species that may be found in the St. Lawrence, or specimens of Algæ from the region at which the fresh and salt waters of the river and gulf come into contact.

Having made these few observations in a popular form, for the benefit of young readers, we shall now proceed with our detailed catalogue of the specimens referred to :—

The references to pages and plates are all, except when otherwise mentioned, to Harvey's " Nereis Boreali-Americana."

Sub-Class.—I. MELANOSPERMEÆ OR OLIVE-COLORED ALGÆ.

Order I.—FUCACEÆ.

Fucus *fastigiatus*, J. Ag. P. 68, pl. III *A*. North Shore of the St. Lawrence.

Fucus *nodosus*, Linn. P. 68. Abundant on all the shores of the North Atlantic.

Fucus *furcatus*, Ag. P. 70. St. Nicholas, in rock pools, within reach of the spray of high tides. This species is obtained in Newfoundland, and is apparently rare on our shores. Harvey says he is not acquainted with it.

Fucus *vesiculosus*, Linn. P. 71. Very abundant on all the North Atlantic shores; remarkable for its air-vessels, which are, however, often absent.

Order III.—LAMINARIACEÆ.

Alaria *Pylaii*, Grev. P. 89. On rocks near low water mark. This species was first described from a Newfoundland specimen, and no other locality is given by Harvey.

Laminaria *Fascia*, Ag. P. 91. On rocks near low water mark. " This species is widely distributed, being found on the Atlantic and Mediterranean shores of Europe, and at the Falkland Islands in the Southern Atlantic." —Harv.

Laminaria *dermatodea*, De la Pyl. P. 92. St Nicholas and Point des Monts, North Shore. Newfoundland is the only habitat given by Harvey. On rocks at and below low-water mark.

Laminaria *longicruris*, De la Pyl. P. 93. Metis—a fragment from the collection of Mr. D. A. Poe.

Laminaria *Phyllitis*, Stack. Harvey's Manual. P. 31. On rocks near low water. This plant is not found in the Ner. Bor.-Am. Our specimen exactly corresponds with the description of the Manual; but Dr. Greville, Mrs. Griffiths, and Dr. Harvey doubt whether this beautiful plant may claim to rank as a species distinct from *L. saccharina*. "The more lanceolate form, delicate substance, and pale yellowish-green colour, constitute the chief marks of distinction."

Laminaria *digitata*, Lam. P. 94. Abundant as far south as Cape Cod.

Agarum *Turneri*, Post. & Rupr. P. 95, pl. V. On rocks below low water mark, Rimouski, South Shore. This plant is peculiar to the Atlantic and Pacific Shores of America. Its common name is Sea-Colander.

Chorda *filum*, Stack. P. 98. Murray Bay. A young specimen clothed with beautiful pellucid grass-green hairs—common on the Northern Shores of America.

Chorda *lomentaria*, Lyngb. P. 98. On rocks at mid-tide. This plant is not easily distinguishable from *Asperococcus echinatus*. "In habit it has more resemblance to it than to *C. filum*; but the structure of the walls is more in accordance with the latter, and it may always be known by its constricted joints."

Order IV.—DICTYOTACEÆ.

Dictyosiphon *fœniculaceus*, Grev. P. 114. On rocks at low water mark. "In a growing state every branch is clothed with long slender pellucid-jointed hairs, which give the plant, when seen under water, a beautiful feathery character."—Harv.

Punctaria *tenuissima*, Grev. P. 115. Parasitic on other Algæ.

Punctaria *plantaginea*, Grev. P. 115. On rocks and stones.

Asperococcus *echinatus*, Grev. P. 117. A plant nearly allied in appearance to *C. lomentaria*.

Asperococcus *compressus*, Griff. Harvey's Manual, p. 42. Murray Bay. This plant is not included in Harvey's

Ner. Bor.-Am.; but it exactly corresponds with the description in the Manual, and does not very much resemble *A. echinatus.* After careful consideration, we are disposed to add it to the American species.

Order V.—Chordariaceæ.

Chordaria *flagelliformis*, Ag. P. 123. In rock pools mid-tide, Murray Bay. This is a remarkably prolific and robust specimen. Its branches are from 6 to 8 inches long.

Chordaria *divaricata*, Ag. P. 124, pl. XI *A.* In rock pools mid-tide, Murray Bay. This is also a remarkably fine specimen. It has shrunk greatly in drying.

Elachista *fucicola*, Fries. P. 131, pl. XI *B.* Parasitic on Fuci and Chordariæ. Metis.

Order VI.—Ectocarpaceæ.

Ectocarpus *brachiatus*, Harv. P. 138. Parasitic on *Fucus vesiculosus.* Murray Bay. Also in the collection of Mr. D. A. Poe from Metis.

Ectocarpus *littoralis*, Lyngb., p. 139. Abundant on *Fucus vesiculosus.* Murray Bay and St. Nicholas.

Ectocarpus *siliculosus*, Lyngb. P. 139. On stones and other Algæ at low water mark. Murray Bay; very abundant and the specimens are very fine.

Ectocarpus *fasciculatus*, Harv. P. 141. Parasitic on *Chordaria.* We are doubtful about this species. The specimen is so infested with Diatomaceæ, that it is very difficult to discover the fructification; but so far as it is discoverable, it has all the appearance of this species.

Sub-Class.—II. Rhodospermeæ or Red Algæ.

Order I.—Rhodomelaceæ.

Odonthalia *dentata* Lyngb. P. 14. In great abundance at Bernaby Island, Rimouski, and frequently found at Murray Bay.

Odonthalia *angustifolia*, Suhr. P. 14. Abundant at Murray Bay. This is a very beautiful plant. It is not described in the Ner. Bor.-Am. Harvey only says of it

that seemingly it is the same as *O. Kamtchatica* Rupr. In appearance it is very distinct from the previous species. It may, we think, be added without hesitation to the North American Algæ.

Rhodomela *subfusca*, Ag. P. 26. On stones in sandy bays and on other Algæ. Point des Monts, North Shore, Rimouski and Metis. This is an exceedingly variable plant, the young fronds spring from the terminations of the old, and in summer give it a very bushy appearance. In its winter garb and in its old state, it is very scrubby and rigid in its branches

Rhodomela *lycopodioides*, Linn. Harv. Man. p. 78. The collector notes regarding this plant that "though common every where it is found in greatest beauty and size—in large bushy fronds of more than a foot and a half in length—at Murray Bay. Some pieces of iron removed from a wreck at Caribou Island were perfectly covered with this Alga." Although Harvey does not include this species in his Ner. Bor.-Am., we cannot doubt its identity with the British species of the name. Its peculiarly graceful branches and the monoliform character of its ultimate pinnæ, which are covered with tetraspores, distinguish it sufficiently from *L. subfusca*. It has no conceptacles.

Rhodomela *gracilis*, Kutz. P. 26, pl. XIII. *C.* This plant is remarkable for its fine pedicellate conceptacles. There is also an entire absence of tetraspores or stichidia. The branching is exceedingly graceful, approaching in appearance to that of *R. lycopodioides*.

Polysiphonia *urceolata*, Grev. P. 32. On stones and other Algæ below low water mark. Murray Bay and Metis.

Polysiphonia *formosa*, Suhr. P. 33. Murray Bay, Rimouski and Metis.

Polysiphonia *fibrillosa*, Grev. P. 43. On stones below low water mark, Point des Monts.

Polysiphonia *violacea*, Grev. P. 44. On other Algæ below low water mark, Murray Bay.

Polysiphonia *fastigiata*, Grev. P. 54. Parasitical on *F. nodosus*. Metis and Point des Monts. The collector remarks, "This plant makes its appearance first at Metis.

I have seen it in such abundance at Nahant that the sight of it here made me feel as if at the ocean side. The plant here is smaller."

Polysiphonia *variegata*, Ag. P. 45. Metis. In the collection of Mr. D. A. Poe.

Polysiphonia *nigrescens*, Grev. P. 49. In shallow rock pools, Metis.

Polysiphonia *nigrescens*, var. *fucoides*, Grev. On stones and other Algæ, Point des Monts.

Polysiphonia *nigrescens*, var. *affinis*, Grev. Parasitical on *Laminaria*, Rimouski.

Order III.—CORALLINACEÆ.

Corallina *officinalis*, Linn. P. 83. On stones and shells abundant.

Order IV.—SPHŒROCOCCOIDEÆ.

Delesseria *sinuosa*, Lam. P. 93. On rocks, Murray Bay. An exceedingly variable plant. " In deep waters the frond often becomes very narrow with filiform lobes produced into long tendrils. The margin of the frond which in most cases is merely denticulate, is occasionally bordered with slender simple or fimbricated lacinulæ, or fringed with great numbers of minute accessory frondlets." *Harv.* The fringed and narrow varieties are very common in the St. Lawrenee. The collector notes regarding this plant, that " it is the only species of this genus I have found elsewhere than at Murray Bay. This place is the garden of the St. Lawrence. "

Delesseria *fimbriata*, De la Pyl. P. 94. Parasitical on *Chætomorpha*. Murray Bay. Newfoundland is the only other locality noted by Harvey who does not appear to have seen the plant. It is one of the most beautiful and curious of the genus. The laciniæ are densely fringed with delicate twisted leaflets.

Delesseria *denticulata*, Mont. P. 94. Parasitical on *Chætomorpha*. Murray Bay, Shores of Labrador and Brandy Pot Island. The fronds are alternately branched.

Delesseria *alata*, Lam. P. 95. North shore of the St. Lawrence, collected by Mr. D. A. Poe. This seems a doubtful specimen, very like *D. fimbriata*, but its leaflets are shorter and entire on the margin. A narrower and more distinct specimen from Kakoona is in my collection.

Delesseria *angustissima*, Griff. P. 95. It is doubtful whether this be not a very extreme variety of the preceeding.

Delesseria *Hypoglossum*, Lam. P. 96. Murray Bay. Collected by Miss Taylor.

Nitophyllum *punctatum*, Grev. P. 104. Mingan Islands. Collected by George Barnston, Esq.

Nitophyllum *Bonnemaisoni*, Ag. Harv. Man. p. 117. Mingan Islands. Collected by George Barnston, Esq. This species is not in the Ner. Bor.-Am., and is new to the American shores.

Order V.—GELIDIACEÆ.

Hypnea *musciformis*, Lam. P. 123. Point des Monts.

Order X.—RHODYMENIACEÆ.

Rhodymenia *pertusa*, J. Ag. P. 147. North shore. Harvey gives also the Straits of St. Juan de Fuca and Greenland. Our specimens are not more than 4–6 inches long. In the more northern seas this plant attains the size of from 1–3 feet.

Rhodymenia *palmata*, Grev. P. 148. Regarding this fine plant the collector notes that it is " common on the south shore and Murray Bay, but not a trace of it is to be found so far north as St. Nicholas and Point des Monts."

Cordylecladia *irregularis*, Harv. P. 156. This plant seems to be very abundant on both shores of the St. Lawrence, but we are somewhat doubtful as to our determination. Both in structure and external appearance it approximates to the description of this species by Harvey. It is a pretty red plant and is remarkable for the secund character of its ultimate ramuli.

Order XI.—CRYPTONEMIACEÆ.

Phyllophora *Brodiæi*, J. Ag. P. 164. In rock pools near low water mark, Murray Bay.

Phyllophora *membranifolia*, J. Ag. P. 165. Murray Bay.

Cystoclonium *purpurascens*, Kutz. P. 170. Collected at Gaspé by Mr. Bell, of the Canada Geological Survey. Found also at Murray Bay. This plant is readily recognized by the nodose swellings in the ramuli. " It is common

throughout the north Atlantic extending on the European side from the glacial ocean to the southern shores of France." Harv.

Iridæa *edulis*, Stack. Harv. Man. p. 150. Not described among the American species in the Ner. Bor.-Am., the specimen before us is small, but the characters are well marked.

Halosaccion *ramentaceum*, J. Ag. P. 194. Common on every shore. Murray Bay, Point des Monts.

Furcellaria *fastigiata*, Lyngb. P. 195. In rock pools near low water mark. Murray Bay and Metis. A robust specimen was collected by Mr. Bell, Can. Geo. Sur. at Gaspé.

Furcellaria *divaricata*, Harv. MS. Deep water, Murray Bay. This plant is neither in the Manual nor the Ner. Bor.-Am. of Harvey, but is so named by him in MS.

Order XIII.—CERAMIACEÆ.

Ceramium *rubrum*, Ag. P. 213. Abundant on stones and other Algæ, Point des Monts. A most Protean plant.

Ceramium *fastigiatum*, Harv. P. 217. Metis.

Ceramium *Hooperi*, Harv. MS. On perpendicular sides of rocks. Murray Bay and St. Nicholas. Not Common.

Ceramium *gracillimum*, Kutz. Harv. Man. p. 163. Collected by Mr. D. A. Poe at Metis.

Ptilota *serrata*, Kutz. P. 222. Very abundant at Murray Bay.

Ptilota *elegans*, Bonnem. P. 224. In the collection of Mr. D. A. Poe. North shore.

Callithamnion *Pylaisæi*, Mont. P. 239. A most beautiful and delicate plant. Murray Bay. Our specimens are in fine fruit.

Sub-Class III.—CHLOROSPERMEÆ OR GREEN ALGÆ.

Order IV.—ULVACEÆ.

Porphyra *vulgaris*, Ag. P. 53. Very abundant on the rocks of both shores. *P. laciniata* is nothing more than a cleft variety of this plant, both are used in England in the preparation of *Marine Sauce*, or laver.

Bangia *fuscopurpurea*, Lyngb. P. 54. On top and within the seams of rocks near high water mark, Point des Monts.

Enteromorpha *compressa*, Grev. P. 57. Extremely common and variable. Under one or other of its many forms this species is found on all parts of our American coasts.

Enteromorpha *intestinalis*, Link. P. 57. In rills of fresh water covered at high tide. Murray Bay.

Enteromorpha *clathrata* var., *erecta*, Lyngb. Harv. Man. p. 214. In rock pools near low water. Murray Bay.

Enteromorpha *clathrata*, var., *ramulosa*, Grev. P. 57. Harv. Man. p. 215. In rock pools. In the Ner. Bor.-Am. Harvey agrees with Greville in considering E. *erecta* and *ramulosa* of authors as varieties, if not also synonyms of E. *clathrata*.

Ulva *Linza*, Linn. P. 59. Common on all the shores; easily known by its tapering base and linear lanceolate form.

Ulva *latissima*, Linn. P. 59. Verycommon. Form polymorphous.

Order VI.—Confervaceæ.

Cladophora *arcta* Dillw. P. 75. On rocks near low water mark. Rimouski and St. Nicholas.

Cladophora *gracilis*, Griff. P. 81. Murray Bay.

Cladophora *lætevirens* Dillw. P. 82. In rock pools at low tide. Metis.

Chætomorpha *melagonium*, Web. & Mohr. P. 85. In rook pools near low water mark, North shore. This plant was formerly called *Conferva melagonium*, but Harv. in the latest of his publications thus designates the genus.

Chætomorpha *longiarticulata*, Harv. P. 86. Parasitical on *Halosaccion*. North shore.

Hormotrichum *Younganum*, Dillw. P. 89. From the iron bar of a buoy, Rimouski. The plants under this genus have hitherto been placed either in *Conferva* or *Lyngbya*.

Hormotrichum *Carmichælii*, Harv. P. 90. On top of stones near high water mark, Murray Bay.

Rhizoclonium *riparium*, Roth. P. 92. In seams of rocks, Murray Bay. Also found in Greenland.

Order IX.—Oscillatoriaceæ.

Lyngbya *ferruginea*, Ag. P. 102. On top of rooks near low water mark, Bic.

RIVULARIÆ, Hass.

Raphidia *viridis*, Hass. British Fresh-water Algæ, p. 265, pl 64, fig. 3. In rock pools, Point des Monts. This plant bears some resemblance to the *Rivularia nitida* of Harvey's Man. p. 222 ; but although a salt-water species it is yet more like the *R. viridis* of Hass. which abounds in the fresh-water of the St. Lawrence.

ARTICLE V.—*Unusual modes of Gestation in Batrachians and Fishes.*

[Prof. Wyman of Harvard has lately returned from an excursion across North America, in the course of which he has collected many curious facts in natural history ; among others, the following, which we extract from a communication to the Boston Society of Natural History.]

"Among Batrachians the circumstances under which the young are developed, though less varied than in some of the other classes of vertebrates, still present a considerable range. By most species the eggs are deposited in the water either upon aquatic plants or on the bottoms ; by others, as in *Salamandra erythronota*, they are laid in damp places under logs or stones ; with some the evolution of the embryo commences a short time previous to the laying of the egg and is completed subsequently, while there are species which are wholly viviparous.

"The most remarkable deviations from the ordinary modes are to be found in those instances in which the eggs, after being laid, are again brought into a more or less intimate relation with the parent, as in the "Swamp toads" (*Pipa Americana*) of Guiana, where each ovum is developed in a sac by itself on the back of the female, in *Notodelphys* of Venezuela, where all the eggs are lodged in one large sac, also on the back, and is analogous to the pouch of the Marsupials, and in *Alytes*, the "Obstetric toad" of Europe, where the eggs are wound in strings around the legs of the male, who takes care of them until they hatch.

"The species, the habits of which are noticed below, and which, in so far as I have been able to learn, have not attracted the attention of naturalists, adds another to the series just mentioned,

though the relation of the fœtus to the parent becomes less intimate than in any of the preceding cases.

"*Hylodes lineatus* (Dum. and Bib.) is very common in Dutch Guiana, and its peculiar habits are well known to the colonists. The first specimen with young which came to my notice had been preserved in alcohol, and was presented to me by Mr. G. O. Wacker, residing at Osembo, on the Para Creek, Surinam, and had been captured at some distance from the water. The young, ten or twelve in number, though separated from the parent, he assured me, when found, were attached to the back.

"In the month of May, 1857, during an excursion to the country inhabited by the Bush negroes, above Sara Creek on the upper Surinam River, I had an opportunity for the first time of seeing these animals carrying their young. The grass and bushes were quite wet from a recent fall of rain, and this seemed the inducement that led them from their hiding places, for when the ground was dry none had been seen. They were very quick in their movements, and when alarmed went at once into the grass and thick bushes. One of my companions, Mr. John Green, and myself succeeded in capturing some specimens, which, as we were just leaving the village, were placed at once in alcohol. In one instance the larvæ were retained permanently adherent to the back of the parent, in consequence of the coagulation of the mucus covering the surface of the body, and are still preserved in the Museum of Comparative Anatomy at Cambridge. The young, from twelve to twenty in number, were collected upon the back of the mother, their heads directed towards the middle line. They were about three-fourths of an inch in length. No limbs were developed, though in some of them the rudiments of a leg existed in the form of a small papilla on either side of the base of the tail. No especial organ was found to aid them in adhering to the back of the parent. The adhesion may have been effected by the mouth. This is rendered probable by the fact that all of them had the mouth in contact either with the skin of the parent or with that of another larva. A viscid mucus covering the integuments undoubtedly assisted in some measure to bring about the same results. However this may be, they retained their places perfectly well, and were not displaced when their mother, closely pursued, carried them through the grass.

"On dissection of the young nothing was found materially different to conditions of the larvæ of other Anoura. The external

gills had disappeared, but were replaced by internal ones, which were arranged as usual on three hyoid arches. The development of the lungs had commenced, and these were represented by a slender conical mass of cells, but not permeable to air. The mouth was provided with finely denticulated horny jaws, and the intestinal canal was shorter and less spirally convoluted than in ordinary larvæ of frogs and toads. The stomach was not so much developed as to be distinguished from the rest of the intestine; but this last, after passing the liver, was somewhat dilated, and contained, as was shown by the microscope, large quantities of yolk cells which had not been absorbed and which were adherent to its walls.

We have here then a larva, in all of the details of its structure, especially in the existence of gills and of a flattened tail, adapted to aquatic locomotion and respiration, yet passing a portion of its time at least on the back of its parent and at a distance from the water.

I was not able to ascertain whether the eggs were primarily deposited in the water or not, but it is well known to some of the colonists that after the larvæ have reached a certain degree of development they are carried about in the manner just described and they do not know them under any other circumstances. The existence of yolk cells in the intestine, shows that for a period at least they may have from these a supply of nutriment. But after this is exhausted, and it appeared to be nearly so in those which I have dissected, how do they obtain their food? In the absence of limbs adapted to terrestrial locomotion can they leave the body of the parent? and if they cannot, do they, as in the case of Pipa and probably in Notodelphys, depend upon a secretion from her?

Among Fishes, as far as at present known, the external conditions under which the eggs are developed are more varied than in any other class of Vertebrates. There are scarce any known conditions of the higher classes to which there are not analogies at least in the class of fishes. Besides the ordinary mode of depositing eggs upon the bottoms, some of the Salmonidæ, like the turtles, bury their eggs, the Lampreys (*Petromyzon*), the Breams, (*Pomotis*), the Hassars (*Callicthys*), the Stickle-backs, (*Gasterostei*), &c., build more or less complete nests. Among some of the Pipe Fishes, (*Syngnathidæ*), the eggs and subsequently the young, are carried in a pouch analogous to that of the opossums and other marsupial animals, and among some of the Sharks

there is a vitelline placenta analogous to the Allantoidian one of the Mammalia.*

To those species enumerated above where the eggs become more or less intimately connected with the body of the parent after they are laid may be added the Aspredos and some species of Bagrus, from Guiana.

Aspredo lœvis (Cuv. and Val.), the "Trompetti" of the colonists, is about fifteen inches in length, and belongs to a remarkable genus of Siluroid fishes, which, in addition to several peculiarities of anatomical structure, are remarkable for carrying the eggs and young attached to the under surface of the body. These fishes are very abundant in the waters of the Surinam where they are taken in the nets with other kinds. They are not used as articles of food except by the negroes, who have a fancy for Siluroids generally, and in consequence these are known among the colonists as *Ningré fisi* or "nigger fish." A general account of the internal structure of Aspredo, is given in the Hist. Nat. des Poissons, by Cuvier and Valenciennes, T. xv, p. 35.

In the month of June the eggs are found adhering to the underside of the body, to the ventral and pectoral fins, and extend as far forward as the under lip, and as far backwards as the middle of the tail. In some however the distribution is much more limited. I was unable to learn anything with regard to the transfer of the ova from the genital orifice to the point of their attachment. The only organ which seems in any way adapted to such a purpose is the slender and flexible tail terminated by a delicate caudal fin. It is possible that the eggs may be deposited on the bottom of the river, and subsequently attached by pressing the underside of the body upon them.

In those individuals where the ova were still in the ovary, but approaching maturity, the integuments of the underside of the

* Prof. Owen (in Philos. Transactions, 1834,) has pointed out the vascular relations of the fœtal Kangaroo to the parent. The chorion is not vascular, but the umbilical vesicle is largely provided with blood vessels, and, as far as his investigations go, affords the principal vascular surface by means of which an interchange takes place between the fœtus and the parent. The vitelline circulation then, as in sharks, is the respiratory circulation. The allantois of the Marsupials appears to remain in a rudimentary condition, and does not form a connection with the parent. Thus the vascular relation of the fœtus of some of the sharks, as Carcharias, with the parent is identical with that of the Marsupials.

body gave no other indications of the changes about to take place than of being quite vascular; the skin was perfectly smooth, no "pores" were visible, but a large vessel was seen emerging from the region of the liver, and descending along the median line gave off branches quite freely to the integuments. This may have some relation to the future development of the pedicles which support the eggs and perhaps to the nutrition of the embryo as will be adverted to hereafter.

In all the specimens which I have had an opportunity of examining, the eggs were either somewhat advanced or quite mature; so that no observations could be made on the earlier conditions of the egg and the formation of its pedicle. The pedicle is a flexible outgrowth from the common integuments, is about two lines in length, is attached to the skin by a slightly expanded base, and spreads out at its summit into a shallow cup or "cupule," for the support of the egg. It is composed almost entirely of fibrous tissue, invested with a layer of tesselated epithelium. In some instances when the eggs were but little advanced, numerous fusiform cells were detected among the fibres. It is vascular, two or three vessels reaching to the cup, where they ramify and form a somewhat extended capillary plexus.

The eggs vary according to the degree of development from the 0.09 to 0.15 of an inch in diameter, and are covered with an external homogeneous membrane, containing minute punctiform depressions—within this is a second, of a brownish color and composed of epithelium. The embryos which were the most advanced and just ready to hatch, had not as yet completely absorbed the yolk, and were coiled up within the membranes, which in consequence of the irregularities of the mass formed by the embryo, had no longer a spherical form.

The eggs are retained in connection with the cup apparently by adhesion alone, for as soon as the fœtus escapes, the egg membranes become very easily detached from the pedicle, and this last as shown by some of the specimens undergoes absorption.

The relation of the embryo to the parent in this singular mode of gestation cannot be determined very accurately, but the vascular plexus in the cup, seems to be more than is necessary for the mere nutrition of the part. The egg increases in size during incubation, those ova in which the development had but slightly advanced measuring from 0.09 to 0.11 of an inch in diameter, while those nearly mature measured from 0.14 to 0.15 of an inch.

How this increase of size of the embryo over the original size of the egg is actually obtained I have no facts to show, but either of two suppositions are probable ; it may be by absorption of materials from the water which surrounds it, or from the capillary plexus of the pedicles, and in this case in a manner analogous to that of Pipa.

Among the Siluroid fishes of Guiana there are several species, which at certain seasons of the year have their mouths and branchial cavities filled either with eggs or young, and as is believed for the purpose of incubation. My attention was first called to this singular habit by the late Dr. Francis W. Cragin, formerly U. S. Consul at Paramaribo, Surinam. In a letter dated August 1854, he says, "the eggs you will receive are from another fish. The different fishermen have repeatedly assured me, that these eggs in their nearly mature state are carried in the mouths of the parent, till the young are relieved by the bursting of the sac. Do you either know or believe this to be so, and if possible, where are the eggs conceived and how do they get into the mouth ?"

In the month of April, 1857, on visiting the market of Paramaribo, I found that this statement, which at first seemed to be very improbable, was correct as to the existence of eggs in the mouths of several species of fish. In a tray of fish which a negro woman offered for sale, I found the mouths of several filled with either eggs or young, and subsequently an abundance of opportunities occurred for repeating the observation. The kinds most commonly known to the colonists, especially to the negroes, are *Jara-bakka*, *Njinge-njinge*, *Koepira*, *Makrede* and one or two others, all belonging either to the genus Bagrus or one nearly allied to it. The first two are quite common in the market and I have seen many specimens of them ; for the last two I have the authorithy of negro fishermen but have never seen them myself. The eggs in my collection are of three different sizes, indicating so many species ; one of the three having been brought to me without the fish from which they were taken.

The eggs become quite large before they leave the ovaries, and are arranged in three zones corresponding to three successive broods, and probably to be discharged in three successive years; the mature eggs of a Jara-bakka eighteen inches long, measure three-fourths of an inch in diameter, those of the second zone one fourth ; and those of the third or very minute, about one sixteenth of an inch.

A careful examination of eight specimens of Njinge-njinge about nine inches long, gave the following results:

The eggs in all instances were carried in the mouths of the males. This protection, or gestation of the eggs by the males, corresponds with what has been long noticed with regard to other fishes, as for example, Syngnathus where the marsupial pouch for the eggs or young is found in the males only, and Gasterosteus where the male constructs the nest and protects the eggs during incubation, from the voracity of the females.

In some individuals the eggs had been recently laid, in others they were hatched, and the fœtus had grown at the expense of some other food than that derived from the yolk, as this last was not proportionally diminished in size, and the fœtus weighed more than the undeveloped egg. The number of eggs contained in the mouth was between twenty and thirty. The mouth and branchial cavities were very much distended, rounding out and distorting the whole hyoid and branchiostegal region. Some of the eggs even partially protruded from the mouth.

The ova were not bruised or torn as if they had been bitten, or forcibly held by the teeth. In many instances the fœtuses were still alive, though the parent had been dead for many hours.

No young or eggs were found in the stomach, although the mouth was crammed to its fullest capacity.

The above observations apply to Njinge-njinge. With regard to Jarra-bakka, I had but few opportunities for dissection, but in several instances the same conditions of the eggs were noticed as stated above; and in one instance, besides some nearly mature fœtuses contained in the mouth, two or three were squeezed apparently from the stomach; but not bearing any marks of violence or of the action of the gastric fluid. It is probable that these found their way into that last cavity after death, in consequence of the relaxation of the sphincter which separates the cavities of the mouth and the stomach. These facts lead to a conclusion that this is a mouth gestation, as the eggs are found there in all stages of development, and even for some time after they are hatched.

The question will be very naturally asked, how under such circumstances, these fishes are able to secure and swallow their food. I have made no observations bearing upon such a question. Unless the food consists of very minute particles, it would seem necessary that during the time of feeding the eggs should be disgorged. If this supposition be correct, it would give a very pro-

bable explanation of the only fact which might be considered at variance with the conclusion stated above, viz., that we have in these fishes a mouth gestation. In the mass of eggs with which the mouth is filled, I have occasionally found the eggs, rarely more than one or two, of another species. The only way in which their presence may be accounted for, it seems to me, is by the supposition that while feeding, the eggs are disgorged, and as these fishes are gregarious in their habits, when the ova are recovered, the stray egg of another species may be introduced into the mouth among those which naturally belong there.

ARTICLE VI.—*Description of some new species of Fossils from the Lower and Middle Silurian Rocks of Canada.* By E. Billings.

(*From the Report of the Geological Survey for* 1860.)

In the Silurian Rocks of Canada and the neighbouring countries there are many species or varieties of that group of the genus *Strophomena* of which *S. alternata* may be regarded as the typical form. These are all closely related and yet exhibit such differences that only those naturalists who entertain wide views upon the subject of the value and significance of specific distinctions, would feel inclined to unite them under one common name. The forms of this group most common in the Lower and Middle Silurian Rocks are *S. alternata*, *S. incrassata*, *S. deltoidea*, *S. camerata*, *S. tenuistriata* and some others to be described hereafter in this paper. The first of these ranges from the Chazy limestone upwards perhaps to the Niagara rocks but is most abundant in the Trenton limestone and Hudson River group. It is also very widely distributed, as it occurs in all parts of the Continent, where the last two formations have been recognized and is also found in the Lower Silurian in England and Ireland. *S. incrassata* has exactly the same form as some of the varieties of *S. alternata* but is never, as far as I have been able to ascertain, more than half the average size of this latter species. It seems to be confined to the Chazy and the Black River limestone or the lower part of the Trenton, and has therefore, a geological distribution different from that of *S. alternata*, a fact which would appear to constitute an additional ground for classifying it as a distinct species. *S. deltoidea* is a Trenton lime-

stone form abundant in certain localities, but not generally distributed. Thus in the State of New York, according to Professor Hall "it abounds at Trenton Falls and at Sugar River in Lewis County," but "is scarcely known as occuring in the Champlaim valley."* In Canada it is found at Lachine and at several other places, but there are hundreds of good exposures of the rock in the Province that have been carefully examined, where not a single specimen has been seen, although in all the localities *S. alternata* is more or less common. *S. camerata* occurs at one spot in the vicinity of Ottawa, but I have never met with it elsewhere. *S. tenuistriata* may be collected in the hard black limestone around the base of the mountain of Montreal, particularly in the neighbourhood of the McTavish monument and also at Ottawa and two or three other places, but does not occur at all in the majority of the localities of the Trenton limestone. These three species, therefore, must have been capable of existing in certain places only, on the bottom of the ocean during the period of the accumulation of this rock, while *S. alternata*, flourished everywhere. Whether or not, therefore, they are to be regarded as distinct species, this much at least seems probable, that they were by some peculiarity in their habits or in their organization, unfitted for so wide a range through the seas as that enjoyed by *S. alternata.*

The question, whether or not these supposed species are really distinct, cannot be answered until naturalists shall have discovered some general law of life by an appeal to which they may in all cases determine what is a species as distinguished from a mere variety. It is scarcely necessary to state that such a law if it do exist at all may remain unknown to man for ages, and in the meantime nearly all determinations of species from varieties where the forms are very closely related may be regarded as not positively established. The physical geologist is more interested in the results of investigations which show that certain forms are confined to particular geological horizons than in those, whose sole object is to determine the exact zoological relations of such forms. If it be true, for instance, that that particular form of the genus called *Strophomena incrassata* is confined to the limestones lying next under the Trenton in the fossiliferous series, it makes no difference to the geologist, whether it

* Palæontology of New York, vol. 1, page 107.

be in reality a distinct species of itself or only a variety of some other species. Its value to him as a guide, while tracing out the geographical distribution of these Rocks, is not at all affected by the zoological question. In demonstrating the physical structure of the country, he can reason upon varieties with as much safety as upon true species, provided that such varieties are confined to and consequently characteristic of particular portions of the geological edifice. It is therefore, of great importance, not only to ascertain to what particular level each variety is confined, but also to determine whether or not such species as range through several formations exhibit any and what change in form on passing from one group of rocks to another. Should it be hereafter, proved that the supposed species above quoted, constitute on purely zoological grounds, but one extensive and variable species still it would be convenient for geological purposes to have a separate name for each variety that can be shewn to be characteristic of a particular geological horizon.

Before entering upon the description of the new species, I shall give a general account of such characters as are common to all the forms of the group typified by *S. alternata.*

STROPHOMENA ALTERNATA, (Conrad.)

In all the forms of this important type, the convexity of the ventral valve has a peculiar contour which may be seen not only in the Lower Silurian but also in the Upper Silurian and even in such Devonian species as *S. Pattersoni*, *S. inequiradiata*, *S. demissa*, *S. concava* and others. That part of the valve which is usually called the visceral disc occupies all the central region of the shell and terminates in a point at the beak. Just in front of the beak it forms a more or less well defined low rounded umbo on each side of which there is a flattened or sub-concave depression extending obliquely outwards to the margin just in front of the cardinal angles. These latter are usually reflected or a little curved upwards from the plane of the lateral margins. The visceral disc is somewhat flattened, gently convex or only slightly elevated throughout the greater part of its extent. In the upper half of the shell it is bounded by the depressions that have been mentioned as existing between the umbo and cardinal angles, but in front and at the sides it terminates where the shell

begins to be bent down to form the deflected margin which runs all round the edge and becomes obsolete on approaching the cardinal angles. This margin varies in width from one-twelfth to two-thirds the whole length of the shell and therefore the disc in some of the varieties occupies nearly the whole superficies of the valve, bnt in others, less than half. In the very young shells in most of the specimens that I have seen, there is no deflected margin and occasionally adult individuals may be found, which on a side view give the outline of an uniform flattened arch from beak to front. In by far the greater number of the specimens however the deflected margin is well defined. The contour of the front of the visceral disc varies according to the form of the deflected margin and is thus either broadly rounded or more or less pointed. In *S. depressa*, which also belongs to this group, the front of the disc, and its sides also, are often nearly straight.

The dorsal valve is flat or only gently concave beneath the visceral disc of the ventral valve, but all round, its curvature conforms to that of the deflected margin.

In the true *S. alternata* the areas of the ventral and dorsal valves are inclined towards each other at an angle varying from 75° to 80°, but this angle never amounts to 90°. It will be observed that in some of the new species hereinafter described it is greater than 90°.

The surface in most of the species exhibits two sets of radiating striæ, the larger of which are about one-twelfth of a line wide in large specimens, and the smaller half that size, from one to ten of the smaller between each two of the larger, the more common numbers being from three to five. Sometimes also the shell is marked with a series of concentric wrinkles.

Of the above characters, those which are confined to the upper half of the shell such as the form of the beak, the umbo, the concave depressions or hollows on each side of the umbo, and the reflected cardinal extremities, are common to all the species and in order to avoid repetition will not be particularly dwelt upon in the following descriptions. The radiating striæ are also very constant in the aspect they present. The only parts which appear to afford permanent variations of much value are the front of the visceral disc the deflected margin and the hinge line. The proportional length and breadth of the shell seems also to be of much importance especially if accompanied by a variation in two or three of the other characters.

STROPHOMENA NITENS. N. S.

Fig. 1.—*Strophomena nitens.* *a* is a section shewing the curvature and obtuse angles formed by the inclination of the areas.

Description.—Transversely semi-oval, sides somewhat straight for one third or a little more of the length from the cardinal angles, and slightly converging towards each other; front angles broadly rounded; front margin gently convex or nearly straight for about one third the width in the middle portion. Wid·h on hinge-line from nine to twelve lines. Length from six to eight lines.

The beak, umbo, depressions on each side of the umbo and the cardinal angles of the ventral valve the same as in *S. alternata.* The deflected margin forms an angle of between 100° and 110° with the general plane of the visceral disc, and occupies on the median line (in all the specimens I have seen) from one third to nearly one half the whole length of the shell.

The dorsal valve is quite flat, or even a little concave, just in front of the beak, but elsewhere curved to correspond with the ventral valve.

The area of the ventral valve lies nearly in the plane of the lateral margins, and the area of the dorsal valve forms with it an angle of about 95°. The height of the area of the ventral valve at the foramen is three fourths of a line in a specimen nine lines wide, and of the dorsal valve about one third of a line. Foramen of ventral valve partly closed by a V-shaped deltidium, the lower open part of which is closed by the strongly projecting deltidium of the dorsal valve.

The width of the foramen is about equal to its height.

The surface is the same as in *S. alternata*, and, when a little worn, presents a smooth shining silken lustre.

When compared with *S. incrassata*, *S. alternata*, *S. deltoidea* , *S. camerata*, or *S. tenuistriata*, it will be seen that this species is shorter in proportion to the width than any of them, and also that the inclination of the areas towards each other differs in forming an obtuse instead of an acute angle.

Locality and Formation.—This species occurs at Charleton Point, Anticosti, in the upper part of the Hudson River group.

Collector.—J. Richardson.

STROPHOMENA CERES. N. s.

Description.—Semi-oval, sides rather straight and a little converging for one third their length; front angles and margins broadly rounded. Width on hinge-line twelve to fifteen lines; length ten to twelve lines.

The ventral valve varies greatly in the amount of its convexity. In some specimens it is depressed convex, and these have almost precisely the aspect of the more flattened forms of *S. alternata.* Others are strongly convex, nearly hemispherical, uniformly arched from beak to front, no deflected margin distinct from the visceral disc, the latter occupying the whole of the shell except a small triangular space at the hinge-angles. Between these two extremes there are individuals which present all the intermediate degrees of convexity, and some in which the deflected margin can be detected with a width equal to half the whole length of the shell.

The surface is the same as that of *S. alternata.*

The area of the ventral valve is one line high in a specimen fourteen lines wide, and lies very nearly in the plane of the lateral margin. The foramen is as wide as high, and closed by a strongly convex deltidium, the lower margin of which is concave to admit the equally convex deltidium of the dorsal valve, whose area is almost half a line wide and forms an obtuse angle of between 90° and 100° with that of the ventral valve. The beak of the ventral valve exhibits in some specimens a small round perforation.

This species differs from *S. nitens* in being in general a little longer proportionally, larger, and more uniformly convex, with scarcely a distinct deflected margin. In *S. nitens* the length is in general only two thirds of the width, but in this species it is always over five sixths.

The angle formed by the inclination of the areas being obtuse instead of acute furnishes the only character as far as I can ascertain by which it can be separated from *S. alternata.*

Locality and Formation.—Charleton Point, Hudson River group, and also at East Point in the Middle Silurian, Anticosti.

Collector.—J. Richardson.

STROPHOMENA LEDA. N. S.

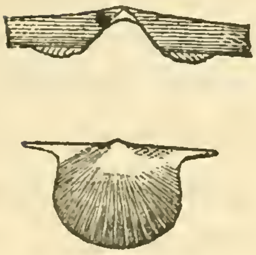

Fig. 2.

Fig. 3.

Fig. 2.—*Strophomena Leda* with a portion of the hinge area of the ventral valve enlarged to shew the striated teeth.

3.—A specimen without ears supposed to be of the same species.

Description.—Shell rather small and thin, semi-oval, the front and front angles regularly rounded, sometimes a little narrower at the base of the ears than at one third the length from the hinge line, the latter usually exceeding the greatest width of the shell, and forming projecting spiniform ears. Width excluding the ears, five to nine lines; length five-sixths of the width; ears one line and a half in length each, in a well preserved specimen five lines wide.

The ventral valve is in the small specimens, depressed convex and nearly uniformly arched from beak to front; the umbo well defined, but the concave depressions on each side rather obscure; no deflected margin. The large specimens (nine lines wide) are sometimes strongly convex. Dorsal valve concave, its curvature corresponding to that of the ventral valve. Surface as in *S. alternata.*

Area of ventral valve half a in line height in a specimen seven lines wide, lying nearly in the plane of the margin, apparently a little sloping outwards, forming an angle of about 100° with that of the dorsal valve, which latter is scarcely one-fourth of a line wide. Foramen not distinctly observed but apparently wider than high.

The detached and empty ventral valves exhibit two rather large triangular hinge teeth, one on each side of the foramen, covered with striæ on the outside in a manner similar to that of the area of those species to which Professor Hall has given the generic name of *Strophodonta.*

The spiniform ears are often either broken or worn away.

Varieties.—Several specimens nine lines wide without ears, and others of the same size strongly convex, and with an indis-

tinct deflected margin, occupying from one-third to one-half the length of the shell, appear to belong to this species.

This species when the ears are broken away has exactly the appearance of *S. alternata*, only that it is never more than half the size. The characters of the hinge areas and teeth taken together with the small size, and hinge ears are abundantly sufficient to show that it is distinct from *S. alternata*. It is a longer shell than *S. nitens*, and is in general destitute of a deflected margin. It is smaller, thinner and less convex than *S. Ceres*.

Locality and Formation.—Anticosti, in strata situated from 800 to 1000 feet above the base of the Middle Silurian, and 250 feet below the rocks containing *Pentamerus oblongus*.

Collector.—J. Richardson.

STROPHOMENA PHILOMELA. N. s.

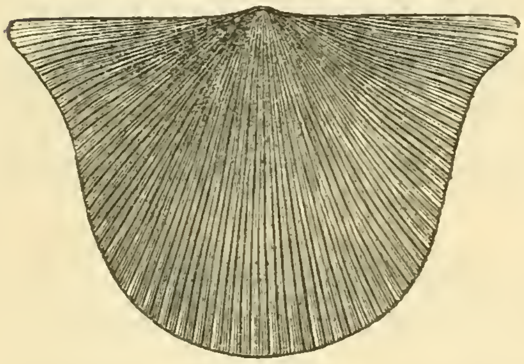

Fig. 4.

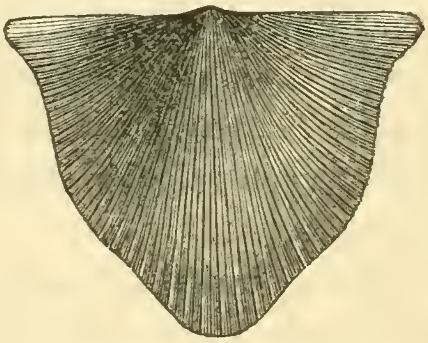

Fig. 5.

Fig. 4.—*Strophomena Philomela.*
5.—The same with a mesial fold.

Description.—Shell rather large; hinge line exceeding the greatest width, forming short rounded ears; sides gently convex, converging towards each other; front margin and angles regularly rounded, sometimes with a projecting lobe in the middle. Width on hinge line from eighteen to twenty four lines. Length from two-thirds to four-fifths the width.

In the ventral valve the umbo and depressions on each side are well defined and exactly like those of the convex form of *S. alternata*. The visceral disc is moderately and broadly convex; the deflected margin from one-fourth to one-third the whole length of the shell, passing into the disc with a short rounded curve. Dorsal valve with the curvature corresponding to that of the ventral valve.

The area of the ventral valve is a little more than half a line in height at the foramen in a specimen two inches wide, and it in-

clines a little outwards apparently forming an angle of from 160° to 170°, with the plane of the lateral margins. The foramen appears to be almost completely closed, but this character has not been ascertained with certainty owing to the imperfection of the specimens examined. The hinge teeth are striated as in *S. Leda.* The area of the dorsal valve is almost linear, or at the most not half the width of that of the ventral valve.

The surface does not differ from that of *S. alternata*, so far as I have been able to ascertain.

Varieties.—One specimen has been found associated with the others of this species in which the length and breadth are almost equal. It has no ears, although it is longer in proportion to the width, and yet it does not appear to differ sufficiently to constitute a distinct species. Another specimen has a rounded fold in the front margin which becomes obsolete at one third the length of the shell.

This species by its projecting ears, narrow areas and striated hinge teeth is most closely related to *S. Leda*, from which it differs in being four times the size. It has so much of the aspect of *S. alternata*, that at present we have no means of distinguishing it from that species without an examination of the hinge area and teeth.

Locality and formation.—Middle Silurian Anticosti, associated with *Pentamerus oblongus.*

Collector.—J. Richardson.

The above four species, *S. nitens*, *S. Ceres*, *S. Leda*, and *S. Philomela* are closely allied to *S. alternata.* The three following have the ventral valve concave, and belong to a very different group, of which *S. filitexta* (Hall) may be regarded as a typical form.

Strophomena fluctuosa. N. s.

Description.—Triangular, or semi-oval, usually widest at the hinge-line, and more or less narrowly rounded, pointed, trilobed, or nasute in front.

Dorsal valve convex, the visceral disc being in general equal to one third the superfices of the whole valve, nearly flat, the remainder abruptly curved down all round so that the lower half of the length of the shell is sometimes at right angles with the upper half. The cardinal angles more or less compressed and often a little reflected, usually forming angular or

narrowly rounded ears. Ventral valve concave, the curvature corresponding to that of the dorsal valve.

Area of dorsal valve lying in the plane of the lateral margin, about one third of a line high. Area of ventral valve forming a right angle with the marginal plane, in large specimens one line or a little more in height at the beak, and gradually decreasing towards the extremities of the hinge-line.

Foramen of ventral valve triangular; the width at the base somewhat exceeding the height, completely closed by a convex deltidium, the basal margin of which is rendered a little concave by the convex margin of the similar deltidium which closes the foramen of the dorsal valve.

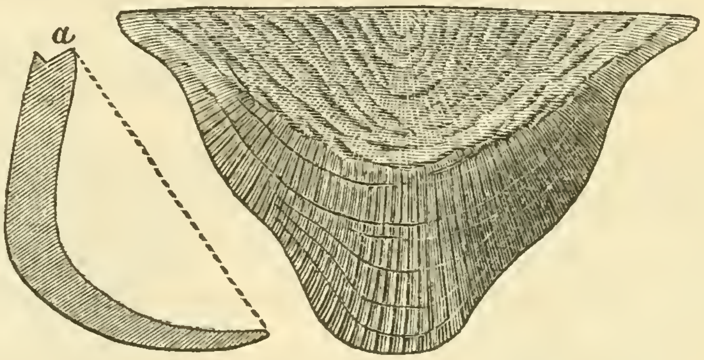

Fig. 6.—*Strophomena fluctuosa.* *a*, section, the dotted line represents the plane of the lateral margin, and it is drawn to shew that the area of the concave or ventral valve is at a right angle to it.

Surface with a set of fine rounded elevated radiating striæ distant from each other usually about half a line, sometimes a little less and occasionally one line. Between each two of these there are from two to ten much finer striæ; the whole crossed by fine crowded concentric lines. In most of the specimens the whole of the upper half of the shell is covered with short undulating wrinkles, which sometimes have a concentric arrangement and often form concentric rows converging from the hinge-line towards the centre of the shell, crossing each other. The specimens from the Trenton limestone are usually without these undulations, but in those from the Hudson River group this character is prominently exhibited.

This shell is somewhat variable in its characters. The visceral disc of the dorsal valve is sometimes confined to a small area around and in front of the beak and along the hinge-line, and in such cases the deflection takes place at one fifth or one fourth the length from the beak. Occasionally a broad rounded elevated

mesial fold extended into a linguiform projection of the middle of the front margin gives to the dorsal valve a trilobate character. The area of the ventral valve is in general at right angles to the plane of the lateral margins, but sometimes it slopes a little forward. In some the hinge-line is greatly extended, the cardinal extremities forming projecting triangular ears.

Width on hinge-line from one inch to one inch and a half. Length variable, from two thirds of the width to four fifths or a little more.

Strophomena deltoidea (Conrad) has the ventral valve convex and may be always distinguished from this even when the hinge-line cannot be seen by the small rounded umbo close to the beak. *S. camerata* and *S. tenuistriata* (Conrad) have also the ventral valve convex. (See Plate 31 A, Vol. I. Pal. N. Y.)

Locality and Formation.—Trenton limestone, City of Ottawa, rare; more common in the Hudson River group, Anticosti.

Collectors.—E. Billings, F. Richardson.

Strophomena Thalia. N. s.

Description.—Semi-oval or sub-triangular, often narrowly rounded or somewhat pointed in front, hinge-line usually greatly exceeding the width of the shell, and forming with the sides an angle of from 70° to 80°. Width at hinge-line from one to two inches, length about five eighths the width.

Dorsal valve moderately convex, depressed towards the cardinal angles, which are a little recurved; umbo flat. On a side-view the outline forms a gentle and nearly uniform curve from the front for about four fifths the length, when it descends with a flat slope to the beak, which it reaches at an angle of from 45° to 60°.

Ventral valve concave, the greatest depth about the middle or a little nearer the beak.

Area of ventral valve moderate, forming an angle of about 100° with the plane of the margin, its height in a specimen two inches wide, one line; foramen triangular, closed by a convex deltidium, its width at the base about one fifth greater than the height. The beak is not perforated in any specimen that I have seen. Area of dorsal valve nearly in the plane of the margin, its width about one third of that of the ventral valve.

Surface with moderately coarse radiating striæ, which increase both by bifurcation and interstitial addition, usually un-

equal but sometimes uniform in size, from ten to fifteen in the width of two lines, crossed by excessively fine crowded concentric lines.

This species is allied to *S. fluctuosa*, but differs in having the areas of the ventral and dorsal valves inclined at an angle which is rather less than a right angle. In its outline it forms nearly an uniform arch instead of being abruptly bent like *S. fluctuosa.*

The dorsal valve of *S. recta* (Conrad) is said to have a slight mesial depression, while the ventral valve is flat. *S. plano-convexa* (Hall) has also a slight mesial depression in the dorsal valve, and is flat or even a little convex in front of the beak of the ventral valve, where this species is concave. It has also a perforated beak, and an area more approximated to the plane of the lateral margins that it is in *S. Thalia.* The three species are, however, notwithstanding these differences, closely related.

Locality and Formation.—Trenton limestone, City of Ottawa.

Collector.—E. Billings.

STROPHOMENA HECUBA. N. s.

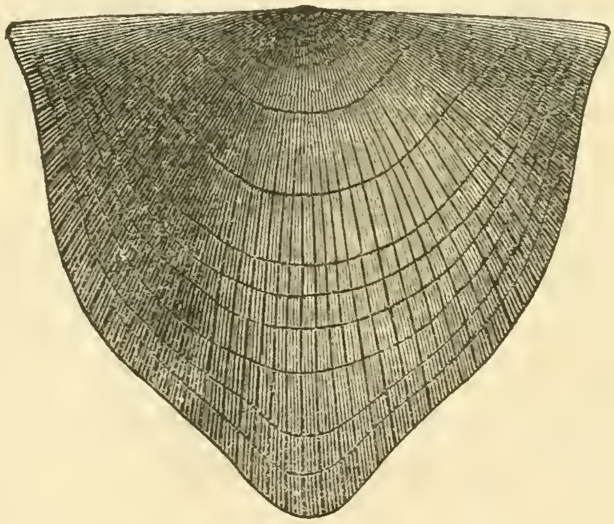

Fig. 7.—*Strophomena Hecuba*, dorsal valve.

Description.—Subtriangular with usually a linguiform projection in front. Width on hinge-line about two inches; length varying from a little less to a little more than the width.

Dorsal valve very convex, nearly regularly arched from beak to front, only a small space at the hinge extremities compressed, the whole of the remainder of the shell exceedingly ventricose, usually a rounded fold in front which becomes obsolete at one fourth the length, area sublinear, scarcely half a line in width in the largest specimens.

Ventral valve depressed convex near the beak, and concave all round near the margin, area about one line wide and forming an angle of about 115° with the plane of the lateral margins. Foramen not observed.

Surface marked with fine radiating striæ, ten or twelve in the width of one line, every third, fourth or fifth one of which is twice the size of the intermediate fine ones. The whole surface is besides (in most specimens) ornamented with indistinct concentric wrinkles from one fourth of a line to two lines in width. There are probably fine concentratic striæ, although I have not, (owing to the partially exfoliated state of the specimens examined) been able to detect them.

This species varies considerably in the amount of the convexity of the dorsal valve and in the size of the mesial fold in front. Some have a wide flat space in the umbonial region, and in such, on a side-view, the outline of the shell rises from the beak at an angle of about 45° only, while in others, which are more ventricose this angle is full 60° with the plane of the margin.

Sometimes the sides are strongly compressed, so that the shell becomes subcylindrical and greatly produced in front, the length exceeding the width. In some specimens the striæ are nearly all of the same size, but in general they alternate as in the finest marked specimens of *S. alternata.*

Resembles *S. Thalia*, but that species has the ventral valve concave nearly to the beak. It is more uniformly gibbous than *S. fluctuosa.*

Locality and Formation.—Anticosti, Hudson River group.

Collector.—J. Richardson.

Dalmanites Bebryx. N. s.

Description.—Elongate-oval, tapering from the head to the somewhat pointed tail. Length of the two specimens examined $1\frac{1}{2}$ inches each, length of head 5 lines, of thorax about 8 lines, of pygidium $5\frac{1}{2}$ lines.

The head is broadly rounded in front and appears to terminate in short spines at the posterior angles. The glabella is broad in front, narrowed behind and covered with small but prominent rounded tubercles about $\frac{1}{8}$ or $\frac{1}{10}$ of a line in diameter and of which there are from 10 to 15 in an area of one line square. The anterior lobe of the glabella is transversely sub-oval and its width about equal to the whole length of the head. It is separated from

the posterior portion of the glabella by strong deep furrows directed obliquely forward and outward. The distance between the inner extremities of these furrows is about $1\frac{1}{4}$ lines in a specimen $1\frac{1}{2}$ inches in length. The second and third lobes are united into one large obliquely triangular lobe with a small transverse pit at the inner margin representing the second furrow. The fourth or posterior pair of lobes are obscurely preserved in the specimens, but they appear to be small. The neck furrow seems to be strongly marked quite across the base of the glabella and the neck segment rather prominent. The eyes as partly exhibited in one of the specimens are rather small, their diameter being one line or perhaps rather more. They appear to be distant a little more than their own length from the posterior margin of the head.

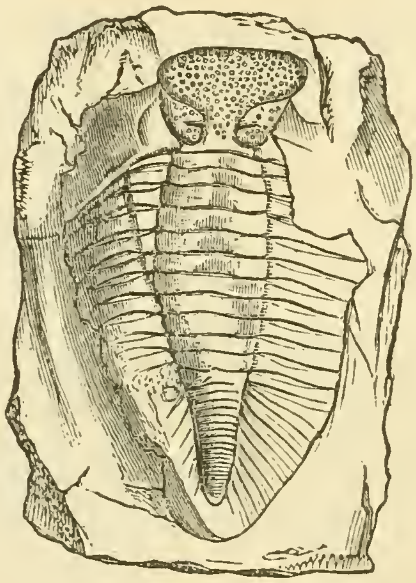

Fig. 8.—*Dalmanites Bebryx.*

The segments of the thorax are not well preserved in the specimens, but there appear to be eleven. The axis when crushed flat four lines wide at the fifth segment and three lines at the last.

The pygidium is triangular; the middle lobe convex, elongate conical, and with from fifteen to twenty segments becoming gradually more numerous in a given space as they approach the posterior extremity. The side lobes have each about ten pleuræ all of which are distinctly grooved along the middle. The pygidium appears to terminate in a rounded point a little turned upwards. I have not seen the margin of the pygidium and have not therefore ascertained its characters.

From the appearance of the specimens I think it almost certain that the posterior angles of the head are produced into short spines.

Several specimens of the pygidium of this rare species and one individual nearly entire but flattened by pressure have been found at Ottawa and are now in the collection of the Survey. I am indebted to Col. Jewett, of Albany, for the loan of the specimen figured. It is more perfect than any of ours.

Locality and formation.—City of Ottawa, Trenton limestone. Occurs also in the State of New York in the same Rock.

Collector.—E. Billings.

DALMANITES ACHATES. N. s.

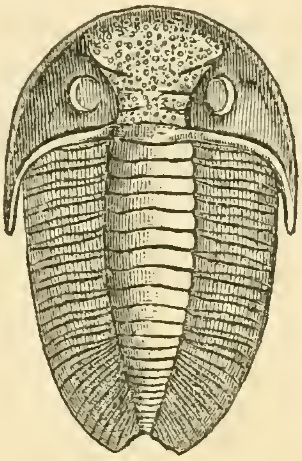

Fig. 9.—*Dalmanites Achates,*

Description.—Elongate-oval, posterior angles of head produced into short spines, proportional length of head thorax and pygidium apparently 5, 7½, 5, total length about one inch and a half.

Head, excluding the spines, very nearly a perfect semi-circle, with a shallow concave marginal groove all round the front and sides, and a strongly defined neck-furrow extending across at less than one line from the posterior margin; glabella equal to the whole length of the head, moderately convex in front, the anterior lobe transversely oval, twice the width of the neck-segment, not defined at the sides in front, but confluent with the surface of the cheeks. The anterior furrows have their inner extremities separated by a space equal to their own length, extending obliquely outwards to points situated a little forward of the inner front angles of the eyes. The middle furrows have their outer extremities opposite the mid-length of the eyes and extend inward in a direction gently inclined forward until their inner extremities are a little within one third the width of the glabella at mid-length from each other. The third furrows are opposite the posterior angles of the eyes, parallel or nearly so with the middle pair and about the same length. The neck furrow is well defined quite

across the glabella. The sides of the glabella are curved a little inward at the posterior lobes and then outwards to the outer extremities of the anterior furrows. The neck segment is large and has its posterior margin rather strongly elevated. The cheeks are moderately tumid. The eyes are semicircular, prominent, one fourth the whole length of the head, about their own length from the posterior and a little more than their length from the anterior margin; the distance between their centres appears to be about one twelfth or one fifteenth greater than the length of the head. The surface of the glabella is ornamented with small rounded tubercles of various sizes, the largest being about one fifth of a line in diameter at the base and, in general, distant once or twice their own width from each other. Surface of cheeks not yet distinctly observed but appears to be smooth. In none of the specimens are the lenses of the eyes preserved.

Thorax with eleven segments; axis well defined and apparently as wide as the side lobes, but this character cannot be sufficiently determined, as all the specimens are crushed. Length of the thorax once and a half the length of the head.

The pygidium in the only specimen that I have seen in which any considerable portion of it remains attached to the body, has the posterior extremity broken away. Judging however from the curves of the posterior margin I think it probable that there is no terminal spine as there is in most of the species of this genus. There are about ten segments in the axis and apparently ten in the side lobes. If the pygidium have no terminal spine the proportional lengths of the specimen figured would be very nearly as follows:

Head,.......	5 lines.
Thorax, ...	$7\frac{1}{2}$ lines.
Pygidium,...	5 lines.
Total	$17\frac{1}{2}$ lines.

On comparison it will be seen that this species differs from *D Bebryx* in the form of the glabella and in the number of segments in the central lobe of the pygidium.

Locality and Formation.—City of Ottawa, Trenton limestone, very rare. *Collector.*—E. Billings.

PHACOPS ORESTES, N. s.

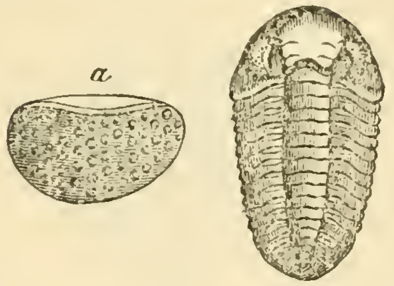

Fig. 10.—*Phacops Orestes.* *a* the eye enlarged.

Description.—Oval, about one inch and a quarter in length. Head somewhat semicircular or sub-crescentiform, the front convex and the posterior margin concave, the angles rather pointed but not produced into spines. Glabella moderately tumid, depressed convex on the top abruptly descending to the front margin, separated from the eyes by a narrow deep furrow, the anterior angles spreading out and becoming obsolete in front of the centres of the eyes, an indistinct marginal groove round the front which does not extend to the cheeks beyond the anterior angles of the glabella. The neck segment is strongly elevated, connected with the main body of the glabella by a narrow convex neck-like ridge with a small rounded tubercle on each side. All of the glabellar furrows are but slightly impressed; the two anterior are situated close to the inner front angles of the eyes, their direction forming with the longitudinal axis of the body an angle of 45°; they slope forward and outward and are short, a little curved and so faintly impressed that they can be seen on very perfect specimens only. The middle furrows lie in a line drawn across the head cutting the eyes at points a little less than one fourth of their length from their front angles; in some specimens these two furrows appear to be straight but in others a little curved the convex side towards the front. The posterior furrows lie a little behind a line drawn through the centres of the eyes. The sides of the glabella are straight or nearly so from the two neck tubercles to the inner front angles of the eyes when they curve a little outwards and become obsolete on approaching the ill-defined anterior angles (of the glabella) which are situated midway between the eyes and the anterior margin.

The eyes are very large, sub-semicircular, the lens-bearing surface not vertical but above sloping a little inwards, more elevated at the anterior than at the posterior extremity; lenses about seventy five arranged in vertical rows in general five in each row. Length

of the eye half the length of the glabella including the neck segment. There is a wide concave groove around the base of the eye outside and a narrow one behind. The cheeks outside of the groove are smooth slightly convex and with no marginal furrow.

The thorax consists of eleven segments, the axis semi-cylindrical gently tapering backwards, about one third the whole width of the thorax when the pleuræ are curved in their natural position but one fourth less than the length of a pleuron straightened out. The fulcrum or bend of the pleuræ is distant from the axis about one half the width of latter.

The pygidium is broadly rounded behind with six or seven ribs on the prominent conical axis and four or five broad flat indistinct ones each divided along the middle in the lateral lobes. The ribs on the axis become more and more indistinct backwards and those on the sides extend scarcely two thirds from it thus leaving a broad smooth margin all round.

The posterior extremity of the axis is not well preserved in any of the specimens that I have seen and I have not therefore ascertained whether or not it is well defined or confluent with the general surface. The surface appears to be smooth but as the best specimens seem to have been a little worn it may be that the glabella is tubercular. It is difficult to get accurate measurements from rolled up specimens, but the following appear to be early the proportions as shewn in two individuals.

	No. 1.	No. 2.
Length of head......	3	4 lines.
" of thorax	6 ?	8 ? lines.
" of pygidium ..	$2\frac{1}{3}$	3 lines.
Total.............	$11\frac{1}{3}$	15

The width of the head measured between the posterior angles is about twice the length.

This species somewhat resembles *P. Stokesii* (Milne Edwards) but that species has the lens-bearing surface of the eye broadest behind while in ours it is broadest in front. There are from six to nine lenses in the vertical rows of *P. Stokesii* but in *Phacops Orestes* only five at the most.

Locality and formation.—Middle Silurian Anticosti and Gaspé.

Collectors.—J. Richardson, Sir W. E. Logan.

CHEIRURUS ICARUS. N. s.

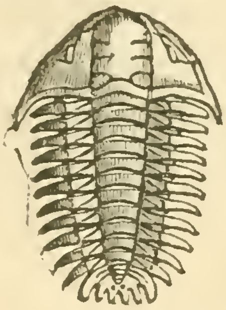

Fig. 11.—*Cheirurus Icarus.*

Description.—Oblong oval, proportional lengths of head, thorax, and pygidium about as $3\frac{1}{3}$, 6, 2.

Head transversely sub-semicircular or sub-triangular, posterior angles terminating in short spines. Glabella oblong, sides parallel, obtusely rounded in front, neck segment elevated at the posterior margin, neck furrow in its middle third narrow deep and parallel with the posterior margin ; at each end for one third the length sloping backwards. The posterior lobes of the glabella transversely oval, completely isolated ; the median furrows lying nearly in a line drawn across the glabella at mid-length, nearly straight, at right angles to the longitudinal axis of the body, their inner extremities separated by about one third the width of the glabella ; the anterior pair at a little more than one fourth the length from the front, a little curved backwards and inwards. The glabella extends the whole length of the head, being separated from the front margin by a very narrow groove only. Cheeks depressed convex ; eyes rather small, nearly semicircular at the base, situated their own length from the posterior margin and half their length from the sides of the glabella. The neck furrow is extended in a sharp groove on the cheeks near to and sub-parallel with the posterior margin, and appears also to run round the sides of the head.

Thorax nearly twice the length of the glabella, of eleven segments ; the axis less than one third the whole width, gently tapering backwards ; the pleural groove short, in length about one half the width of the axis, crossing the pleuræ obliquely outwards and downwards at an angle of about 45°.

The pygidium is about half the length of the glabella, composed of three articulations, the backward curving extremities of which form six short obtuse points.

Surface not well preserved, but apparently somewhat smooth.

This species apparently resembles *C. bimucronatus* (Murchison),

but differs by having the glabella parallel-sided instead of broadest in front, the terminal points of the tail obtusely instead of sharply pointed, and the eyes further forward, being opposite the second instead of the third pair of glabellar lobes.

The largest specimen I have seen is about eleven lines in length.

Locality and Formation.—Anticosti, Hudson River group.

Collector.—J. Richardson.

PROETUS ALARICUS. N. s.

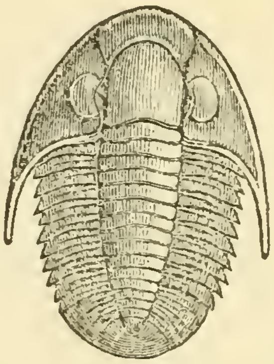

Fig. 12.—*Proetus Alaricus*, enlarged 2½ diameters.

Description.—Oval, proportional lengths of head, thorax, and pygidium about as 2, 2, 1.

Head excluding the spines semicircular with a broad shallow marginal groove all round; spines extending backwards to the sixth pleura. Glabella obtusely conical, about three fourths the length of the head, width at neck segment four fifths the length (of the glabella), sides parallel or very slightly inclining towards each other for five sixths of the length, then curving round to form the obtusely rounded front, neck furrow deep and narrow. Eyes large, obtusely conical, half the length of the glabella, their posterior angles on a line with the neck furrow, a little more than their own length from the front margin, their bases on the inside only separated from the glabella by an angular furrow.

Thorax with the axis prominent, semicylindrical, gradually tapering backwards, about one third the whole width of the body. There appear to be ten segments in the thorax.

Pygidium semicircular with a prominent conical axis, which is well defined at its posterior extremity and exhibits five or six segments. The side lobes of the pygidium appear to have five or six ribs.

The only specimen I have seen is five lines in length but perfect.

About the size and shape of *P. latifrons* (McCoy), but in that

species there is a row of tubercles along the dorsal furrows, and a very strong one at each end of the neck segment, and, besides, the glabella is more narrowed towards the front than it is in our species.

The surface appears to be smooth.

Locality and Formation.—Anticosti, Hudson River group.

Collector.—J. Richardson.

ARTICLE VII.—*Description of a new Palæozoic Starfish of the genus* PALÆASTER, *from Nova Scotia.* By E. BILLINGS.

PALÆASTER PARVIUSCULUS. N. S.

Description.—The specimen is about six lines in diameter. The rays are two lines in length and one line and a half in width at the base, tapering at an angle of a little less than 45°. The five oral plates are sub-pentagonal about half a line in width. The first adambulacral plates of each pair of adjacent rays are in contact with each other outside of the oral plates, and not completely separated as they are in *P. Niagarensis.* There are six or seven adambulacral plates on each side of the ambulacral groove in each ray, and they gradually decrease in size from the oral plate outwards to the point of the ray. The width of the ambulacral groove is equal to one-third the width of the ray and consequently the adambulacral rows of plates are also each equal to one-third the whole width of the ray. In each groove there are two rows of small and apparently nearly square ambulacral plates, twelve or fourteen in each row, and they seem to be continued round on the inner margin of the oral plates; the mouth is about one line wide.

This species differs from *P. Niagarensis,* (Hall), (Pal. N. Y., Vol. 2, page 247, pl. 51, figs. 21, 22, 23,) in being smaller, the rays not so slender, and more importantly in the junction of the adambulacral plates outside of the oral plates.

In the 3rd Decade of the Geological Survey I have defined the genus *Stenaster* as differing from *Palæaster,* by the possession of

ten oral plates instead of five. The discovery of a second species with only five oral plates confirms the opinion there expressed that *Palæaster* is a genus quite distinct from *Stenaster*.

For the privilege of describing this highly interesting fossil I am indebted to Dr. J. W. Dawson, LL.D., to whose cabinet it belongs. It was found by the Rev. D. Honeyman, at Arisaig, in Nova Scotia.

Locality and Formation.—Arisaig, Nova Scotia,—The specimen is a nearly perfect impression of the underside of the fossil in a small water worn fragment of slate, of the lower Arisaig series, supposed to be of middle Silurian age.

Miscellanies.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

C—GEOLOGY.

President.—Sir Charles Lyell, L. L. D.; D. C. L.; F. R. S.

The Prince Consort having entered the Section Room, Sir C. Lyell spoke as follows:—

ANTIQUITY OF THE HUMAN RACE.

No subject has lately exited more curiosity and general interest among geologists and the public than the question of the antiquity of the human race; whether or no we have sufficient evidence to prove the former co-existence of Man with certain extinct mammalia in caves or in the superficial deposits commonly called drift or "diluvium." For the last quarter of a century, the occasional occurence in various parts of Europe, of the bones of man or the works of his hands, in cave-breccias and stalactites associated with the remains of the extinct hyæna, bear, elephant, or rhinoceros, have given rise to a suspicion that the date of man must be carried further back than we had heretofore imagined. On the other hand, extreme reluctance was naturally felt on the part of scientific reasoners, to admit the validity of such evidence, seeing that so many caves have been inhabited by a succession of tenants, and have been selected by man, as a place not only of domicile, but of sepulture,

while some caves have also served as the channels through which the waters of flooded rivers have flowed, so that the remains of living beings which have peopled the district at more than one era may have subsequently been mingled in such caverns and confounded together in one and the same deposit. The facts, however recently brought to light during the systematic investigation, as reported on by Falconer, of the Brixham Cave, must, I think, have prepared you to admit that scepticism in regard to the cave-evidence in favor of the antiquity of man had previously been pushed to an extreme. To escape from what I now consider was a legitimate deduction from the facts already accumulated, we were obliged to resort to hypotheses requiring great changes in the relative levels and drainage of valleys, and, in short, the whole physical geography of the respective regions where the caves are situated —changes that would alone imply a remote antiquity for the human fossil remains, and makes it probable that man was old enough to have coexisted, at least, with the Siberian mammoth. But, in the course of the last fifteen years, another class of proofs have been advanced, in France, in confirmation of man's antiquity, into two of which I have personally examined in the course of the present summer, and to which I shall now briefly advert. First, so long ago as the year 1844, M. Aymard, an eminent palæontologist and antiquary, published an account of the discovery in the volcanic district of Central France, of portions of two human skeletons (the skulls, teeth, and bones), embedded in a volcanic breccia, found in the mountain of Denise, in the environs of Le Puy en Velay, a breccia anterior in date to one at least, of the latest eruptions of that volcanic mountain. On the opposite side of the same hill, the remains of a large number of mammalia, most of them of extinct species, have been detected in tufaceous strata believed, and, I think, correctly, to be of the same age. The authenticity of the human fossils was from the first disputed by several geologists, but admitted by the majority of those who visited Le Puy and saw, with their own eyes, the original specimen now in the museum of that town. Among others, M. Pictet, so well known to you by his excellent work on palæontology, declared after his visit to the spot, his adhesion to the opinions previously expressed by Aymard. My friend, Mr. Scrope, in the second edition of his volcanoes of Central France, lately published, also adopted the same conclusion, although after accompanying me this year to Le Puy, he has seen reason to modify his views. The result of our joint examination,

a result which, I believe essentially coincides with that arrived at by M. M. Hébert and Lartet, names well known to Science, who have also this year gone into this enquiry on the spot, may thus be stated. We are by no means prepared to maintain that the specimen in the museum at Le Puy, (which unfortunately was never seen in situ by any scientific observer), is a fabrication. On the contrary we incline to believe that the human fossils in this and some other specimens from the same hill, were really imbedded by natural causes in their present matrix. But the rock in which they are entombed consists of two parts, one of which is a compact, and for the most part thinly laminated stone, into which none of the human bones penetrate; the other containing bones, is a lighter, and much more porous stone, without lamination, to which we could find nothing similar in the Mountain of Denise, although both M. Hébert and I, made several excavations on the alleged site of the fossils. M. Hébert therefore suggested to me that this more porous stone which resembles in colour and mineral composition, though not in structure, parts of the genuine old breccia of Denise, may be made up of the older rock broken up and afterwards re-deposited, or as the French say 'remané,' and therefore of much newer date.—An hypothesis which well deserves consideration but I feel that we are at present so ignorant of the precise circumstances and position under which these celebrated human fossils were found, that I ought not to waste time in speculating on their probable mode of interment, but simply declare that in my opinion they afford no demonstration of Man having witnessed the last volcanic eruptions of Central France. The skulls, according to the judgment of the most competent osteologists who have yet seen them, do not seem to depart in a marked manner from the modern European, or Caucasian type, and the human bones are in a fresher state than those of the *Elephas meridionalis* and other quadrupeds found in any breccia of Denise which can be referred to the period even of the latest volcanic eruptions.

But while I have thus failed to obtain satisfactory evidence in favour of the remote origin assigned to the human fossils of Le Puy, I am fully prepared to corroborate the conclusions which have been recently laid before the Royal Society by Mr Prestwich, in regard to the age of the flint implements associated in undisturbed gravel, in the north of France, with the bones of Elephants, at Abbeville, and Amiens. These were first noticed at Abbeville, and their true geological position assigned to them by M. Boucher

de Perthes, in 1849, in his 'Antiquités Celtiques,' while those of Amiens were afterwards described in 1855, by the late Dr. Rigollet. For a clear statement of the facts, I may refer you to the abstract of Mr. Prestwich's Memoir, in the Proceedings of the Royal Society for 1859, and have only to add that I have myself obtained abundance of Flint Implements (some of which are laid upon the table) during a short visit to Amiens and Abbeville. Two of the worked Flints of Amiens were discovered in the gravel-pits of St. Acheul—one at the deph of 10, and the other of 17 feet below the surface, at the time of my visit; and M. Georges Poucht, of Rouen, author of a work on the 'Races of Man,' who has since visited the spot, has extracted with his own hands one of these implements, as Messrs Prestwich and Flower had done before him. The stratified gravel resting immediately on the chalk in which these rudely fashioned instruments are buried, belongs to the post-pliocene period, all the fresh water and land shells which accompany them being of existing species. The great number of the fossil instruments which have been likened to hatchets, spearheads, and wedges, is truly wonderful. More than a thousand of them have already been met with in the last ten years, in the valley of the Somme, in an area 15 miles in length. I infer that a tribe of savages, to whom the use of iron was unknown, made a long sojourn in this region; and I am reminded of a large Indian Mound, which I saw in St. Simond's Island, in Georgia—a mound 10 acres in area, and having an average height of five feet, chiefly composed of cast-away oyster shells, throughout which arrow-heads, stone-axes, and Indian pottery are dispersed. If the neighbouring river, the Alatamaha, or the sea which is at hand, should invade, sweep away, and stratify the contents of this mound, it might produce a very analogous accumulation of human implements, unmixed perhaps with human bones. Although the accompanying shells are of living species, I believe the antiquity of the Abbeville and Amiens flint instruments to be great indeed if compared to the times of history or tradition. I consider the gravel to be of fluviatile origin, but I could detect nothing in the structure of its several parts indicating cataclysmal action, nothing that might not be due to such river-floods as we have witnessed in Scotland during the last half century. It must have required a long period for the wearing down of the chalk which supplied the broken flints for the formation of so much gravel at various heights, sometimes 100 feet above the present level of the Somme, for the deposition of fine

sediment including entire shells, both terrestrical and aquatic, and also for the denudation which the entire mass of stratified drift has undergone, portions having been swept away, so that what remains of it often terminates abruptly in old river cliffs, besides being covered by a newer unstratified drift. To explain these changes I should infer considerable oscillations of the land in that part of France—slow movements of upheaval and subsidence, deranging but not wholly displacing the course of the ancient rivers. Lastly, the disappearance of the Elephant, Rhinoceros, and other genera of quadrupeds now foreign to Europe implies, in like manner, a vast lapse of ages, separating the era in which the fossil implements were framed and that of the invasion of Gaul by the Romans.

Among the problems of high theoretical interest which the recent progress of Geology and Natural History has brought into notice, no one is more prominant, and, at the same time, more obscure, than that relating to the origin of species. On this difficult and mysterious subjects a work will very shortly appear, by Mr. Charles Darwin, the result of twenty years of observation and experiment in Zoology, Botany and Geology, by which he has been led to the conclusion that those powers of nature which give rise to races and permanent varieties in animals and plants, are the same as those which in much longer periods, produce species, and, in a still longer series of ages, give rise to differences of generic rank. He appears to me to have succeeded, by his investigations and reasonings, to have thrown a flood light on many classes of phenomena, connected with the affinities, geographical distribution, and geological succession of organic beings, for which no other hypothesis has been able, or has even attempted, to account.

Among the communications sent in to this Section, I have received from Dr. Dawson, of Montreal, one confirming the discovery which he and I formerly announced, of a land shell, or pupa, in the coal formation of Nova Scotia. When we contemplate the vast series of formations intervening between the Tertiary and Carboniferous Strata, all destitute of air-breathing mollusca, at least of the terrestrial class, such a discovery affords an important illustration of the extreme defectiveness of the geological records. It has always appeared to me that the advocates of progressive development have too much overlooked the imperfection of these records, and that, consequently a large part of the generalization in which they have indulged in regard to the first appearance of the different classes of animals, especially of air-breathers, will have to be modi-

fied or abandoned. Nevertheless, that the doctrine of progressive development may contain in it the germs of a true theory, I am far from denying. The consideration of this question will came before you when the age of the White Sandstone of Elgin is discussed—a rock hitherto referred to the Old Red, or Devonian formation, but now ascertained to contain several reptilian forms, of so high an organisation as to raise a doubt in the minds of many geologists whether so old a place in the series can correctly be assigned to it.

The Late Professor George Wilson of Edinburgh.

We observe with deep regret the announcement of the decease of this excellent and able man. In the great work of wedding science to the useful arts, and in the power of making its hardest truths intelligible and acceptable to the common mind he has left few equals and no superior. We copy the following notice from the "Scottish Press":

THE death of Professor George Wilson is an event with cannot but be deeply and widely felt. By many amongst us it will be deplored as a grievous personal loss, to the interests of science generally, it is great indeed, but to the University of Edinburgh it may almost be said to be irreparable. We have no wish to magnify the acquirements of the dead at the expense of those of the living, nor would we wish it to be thought that we write under a sense of despondency occasioned by the removal of one who was ao wise and kind a counsellor; but Dr. George Wilson's connection with the University and the department of science in which he laboured so ardently until the close of his life was in one sense so peculiar as to justify the remark we have made. The Chair of Technology which he was destined to fill for so short a time, was not so much created for him as by him. The foundation of his Professorship was, so to speak, only the recognition of his untiring efforts for the advancement of truth and the application of science to the industrial arts. It was felt not only that he was the best man who could be selected, but that he was the only man who fulfilled all the conditions necessary to render such a professorship as that of Technology permanently effective. The saying that thoroughly original men not only make their own instru-

ments, but, humanly speaking, create occasion for the use of them, was never more clearly illustrated than in the case of Dr. George Wilson. And it is because we know that everything, or nearly everything, connected with the position from which death has just called him, owed its existence to his wisdom, his zeal, and his never flagging energy that we feel his death to be so great a public loss. It will never be possible to estimate with anything like correctness the amount of physical and mental labour which he endured in order to fulfil the objects contemplated in the foundation of his Professorship, and to carry out the projected Industrial Museum of which he was appointed curator. His duties in the class-room, arduous as they were, did not represent a tithe of that labour. The clearness of his mind, the warmth of his heart, the graces of his style, and the natural buoyancy of his temperament, made his duties as a teacher seem as light as they were pleasant. No man better knew how to make the portals of the temple of knowledge inviting, and in a secular as well as a sacred sense, wisdom's ways were ways of pleasantness to him and all whom he sought to teach. Duty, "the stern lawgiver," ever were a smile for him, and his works abundantly prove that while he laboured as comparatively few are capable of labouring to extend the boundaries of knowledge, he never ceased to look forward, with the eye of steady faith, to that state of things in which we shall no longer see darkly as through a glass. It was his delight to think that those who reverently sought to know something of the Creator's work here, had begun studies that would never end, and he was wont to say that "the shortest lesson in heaven will teach more than the longest upon earth.

A brief notice like this affords us no opportunity of saying anything satisfactory as to the position to which Dr. George Wilson attained as a man of science and of letters. But it is scarcely necessary that anything should be said, for the sense of his loss attests the value of his scientific labours, and his books afford abundant evidence of the fine tone of his mind. His "Chemistry of the Electric Telegraph," and "Chemistry of the Stars" though scientific treatises in the best sense of the word, are felt by those who read them to be something more than this; they are the products of a highly poetical, as well as an accurate and well-balanced mind. His fertile imagination, and lively fancy, enabled him to impart not only lucidity, but attractiveness

to themes which by others have been rendered obscure and uninviting. His delicate and often subtle humour, too, played around such themes relaxing their gravity and lighting them up. Above all these characteristics of his literary works, is the steadfast faith and deep religious feeling which pervades them. In none is this so manifest, as in his Life of Dr. John Reid, one of the most delightful examples of biography within our knowledge. To Dr. George Wilson, religion was not only not a gloomy thing, but it was the brightness of existence. It not only cheered him in many days of prostration from severe bodily affliction, but it was an element in almost all his studies, and a thing of his daily laborious life. And we have reason to know, that during his last days on earth, he felt it to be indeed the peace of God, and the firm anchor of his soul.

REVIEWS AND NOTICES OF BOOKS.

HANDBOOK OF GEOLOGICAL TERMS AND GEOLOGY, by DAVID PAGE, E.G.S., Author of the Advanced Text Book of Geology. *Edinburgh* and *London:* W. Blackwood & Sons. *Montreal:* B. Dawson & Son. pp. 416, $2.

Such a Handbook as this is has long been a great desideratum to the reading public. The "hard words and forbidding technicalities" of science which appear to beginners of so difficult acquirement, are here explained and made intelligible in brief and simple language. The ordinary reader will find the information he requires, generally in the first and second sentences of a definition, while what follows is more especially addressed to students and other professional enquirers. This book is just the thing for students, and for those who attend geological lectures, or read geological books. As the first book of the kind that has yet appeared, it is a most meritorious production. Although far from complete it yet contains nearly every term to be met with in ordinary books on geology. In no other single work can the same information be obtained. The defintions may be received with perfect confidence. The author is well known as a most painstaking and careful practical geologist.

EVENINGS AT THE MICROSCOPE ; or Researches among the Minuter Organs and Forms of Animal Life. By P. H. GOSSE, F.R.S. *New York:* D. Appleton & Co. *Montreal:* B. Dawson & Son. pp. 480.

Little need be said in commendation of this new work by Mr· Gosse. His popular writings in the department of Zoology are so well known and highly valued by Students of Natural History, that any thing on his favorite science, which he may now publish, is sure to meet with a favorable reception. To open the path to the myriad wonders of creation which, altogether unseen by the unassisted eye, are made cognisable to sight by the aid of the microscope is the aim and scope of this volume. The revelations of the microscope in the department of the organic world are of the most wonderful and interesting kind, and may well attract the attention of all intelligent and educated persons. The staple of this book consists of original observations by the author. He has set down simply what he himself has seen and what may be seen by any one with the aid of a microscope of ordinary power. He has relieved the dryness of technical description by a colloqi-al and familiar style in a series of imaginary microscopical *conversaziones.* The precision essential to science has, however, never been sacrificed. Throughout the work considerable information is given on the selecting, securing and preparing objects for examination under the microscope, which cannot fail to be highly useful to those who have not books at hand containing special directions on these points. In almost every instance the objects selected for illustration are common things, such as any one with access to the sea-shore or country-side may easily obtain. The book contains one hundred and thirteen illustrations, all of which, with the exception of eighteen, are from the author's own pencil They are also, even in this American edition of the work, engraved with much accuracy and beauty. To the young we cannot too highly commend this book. With the aid of a microscope its interest will be greatly increased, but with or without such a companion it cannot fail to prove highly instructive.

DURA DEN ; a Monograph of the Yellow Sandstone and its remarkable Fossil remains. By the Rev. JOHN ANDERSON, D.D., F.G.S., &c. With illustrations. *Edinburgh:* Thos. Constable & Co. *Montreal:* B. Dawson & Son.—imp. 8 vo. pp. 96, $3·50.

This is a truly sumptuous book which any geologist will regard as a real luxury. The illustrations are in the highest style of

lithographic art and artistic beauty. The two finest and largest are drawn by the fair hand of Lady Kinnaird, and are of unquestionable excellence. The writer is well known as a distinguished amateur geologist. His name is associated with some important discoveries in this department of Science. Lately the remarkably well preserved fossils of a district in Fifeshire, Scotland, called Dura Den, has attracted the attention of geologists and led to an interesting determination of the position of the rocks in which they are embedded. The fossils are now regarded, on almost unquestionable evidence, to belong to the Devonian or old red Sandstone formation. At first, from their contiguity to the coal fields of Fifeshire, these rocks were supposed to have some relation to the lower members of the Carboniferous system, but the careful examination of their fossils and the related strata have led the chiefs of geological science to regard the Yellow Sandstone of Dura Den, as a curious and most interesting section of the great Devonian System. We cordially recommend this book to those interested in the progress of Geological Science.

NUGGETS FROM THE OLDEST DIGGINGS OR RESEARCHES IN THE MOSAIC CREATION. By R. W. VANDYK. *Edinburgh:* Thos. Constable & Co. *Montreal:* B. Dawson & Son.

This is another book on the great question of the reconciliation of the Mosaic Narrative of Creation, with the facts of physical science. Notwithstanding the uncouth title, the book is written with much vigour and eloquence. There is no pretension to a critical examination of the text with this branch of the subject our author does not intermeddle. Nor does he claim any higher acquaintance with science than that which may be obtained from a careful study of good books. The author persuades himself that he has made a grand discovery which removes all the difficulties which have hitherto perplexed the wisest of men, and sheds a perfect flood of light upon the scripture narrative. He is evidently in a very happy frame of mind, and writes in a style of delightful enthusiasm. "Happy is he who knoweth the causes of things." Our authors' idea is that, with the exception of the very first act, which was the creation of the substance of the universe, the whole events narrated in Genesis i. were truly effects of the laws given to the created mass, showing themselves gradually and in succession, and by a process

which, if witnessed, would have appeared to be exactly the same natural and unmiraculous operation of cause and effect with which we are familiar. After the first creative act, what is described is the formation of earth and its tenants out of a disorderly mass of matter; and this is represented as having been accomplished by movements within the mass itself, that is to say, by means of second causes." This is the theory which the book works out with some ability and ingenuity. If it is not altogether new, it is at least modern. We cannot say we are convinced of its truth. We have no faith in unscientific treatments of the physical phenomena of the universe, or in unlearned criticisms of the sacred text. No man should attempt the discussions of the topics contained in this book who has not had practical acquaintance with the subjects which it involves. The idea of all pervading law in the production of physical phenomena is that which Baden Powell attempts to demonstrate with rare ability in his recent works. We do not recognise any special feature in the "Nuggets from the oldest Diggins" that entitles it to a very high rank in the literature of the subject on which it treats. It may be read with interest by the curious, and be regarded as another addition to the unsuccessful attempts to settle the disputed interpretation of the Mosaic cosmogony.

On the Origin of Species by means of Natural Selections, or the preservation of favoured Races in the Struggle for Life. By Ch. Darwin, M.A., &c., &c. *New York:* D. Appleton & Co. *Montreal:* B. Dawson & Son.

This is an abstract of a larger work in course of preparation. It is entitled to most careful perusal. The author is a well known and distinguished Naturalist. He has given much attention to and spent now twenty years of his life in the prosecution of the subject of this book. The title is a good description of its contents. It deals with questions of Natural History in a way most masterly and profound. That its views will meet with much opposition is to be expected. Few will be disposed to go the sweeping length to which our author is disposed to go in the logical issue of his theory. We merely call attention to this able work in the mean time. It promises to create quite a furor in the minds of scientific enquirers. We hope to present our readers with a thorough review of the work either from the pen of one of the Editors, or from the pages of one of the earliest scientific magazines of Europe or America.

MONTHLY METEOROLOGICAL REGISTER, ST. MARTINS, ISLE JESUS, CANADA EAST, (NINE MILES WEST OF MONTREAL,) FOR THE MONTH OF DECEMBER, 1859.

Latitude, 45 degrees 32 minutes North. Longitude, 73 degrees 36 minutes West. Height above the level of the Sea, 118 feet.

BY CHARLES SMALLWOOD, M.D., LL.D.

Day of Month.	Barometer, corrected and reduced to 32° F. (English inches.)			Temperature of the Air.—F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.			Direction of Wind.			Mean Velocity in Miles per hour.			RAIN. Amount of, in inches.	SNOW. Amount of, in inches.	WEATHER, CLOUDS, REMARKS, &c. &c. [A cloudy sky is represented by 10, a cloudless one by 0.]		
	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p.m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.			6 a. m.	2 p. m.	10 p. m.
1	29.681	29.520	29.568	20.2	35.0	42.1	.091	.190	.261	.88	.95	.98	N. E. by E.	W. by N.	S. S. W.	3.00	0.60	14.12	Inapp.	......	Cu. Str. 10.	Cu. Str. 10.	Rain.
2	30.111	30.062	30.096	22.3	17.6	9.0	.084	072	.051	.71	.75	.77	N. N. W.	N. by E.	E. by S.	16.27	4.30	4.46	......	1.90	" 10.	" 10.	Snow.
3	625	661	724	−12.0	10.0	−3.0	.019	.054	.032	.56	.78	.82	W. by S.	E. by N.	N. E.	16.21	4.01	0.71	......	......	Clear.	Clear.	C. C. Str. 10. Lunar Halo.
4	575	586	361	−3.0	15.4	10.9	.032	.080	.054	83	91	78	N. E. by E.	N. E. by E.	N. E. by E.	16.17	12.43	28.30	......	3.50	Snow.	Snow.	Snow.
5	323	220	232	11.0	23.7	24.2	.062	.117	.123	89	90	93	N. E. by E.	N. E. by E.	N. E. by E.	11.93	8.12	4.02	......	......	"Verglas."	Rain.	Rain.
6	099	29.934	29.782	26.1	36.4	39.2	.140	.191	.232	98	90	96	N. E. by E.	E. S. E.	S. E. by E.	0.71	3.42	6.94	0.360	......	Rain.	"	"
7	29.805	616	950	35.0	32.6	27.4	.197	.176	.129	95	93	88	S. S. W.	S. W.	W. by S.	14.42	4.41	14.70	0.946	......	"	"	Cu Str. 8.
8	30.109	30.201	30.214	−0.9	12.2	3.2	.036	.045	.043	84	60	80	W. by S.	W. by S	S. E. by E.	18.42	2.65	2.41	......	......	Clear.	Clear.	" 2.
9	177	29.950	29.823	1.1	19.1	19.0	.040	.077	.081	85	76	78	S. E. by E.	S. E. by E.	S. E. by E.	1.41	4.46	8.22	......	0.70	Cu. Str. 2.	Snow.	Snow.
10	29.937	30.136	30.186	17.1	9.2	1.0	.084	.050	.040	91	70	85	W. by S.	W. by S.	S. S. W.	9.92	1.51	16.75	......	2.60	Snow.	Cu. Str. 4.	Clear.
11	845	29.788	29.466	1.0	9.0	12.2	040	.051	.066	85	77	91	N. E. by E.	N. E. by E.	N. E. by E.	1.22	2.43	2.65	......	1.10	Cu. Str. 10.	" 10.	Snow.
12	500	663	810	−2.0	−6.6	−10.6	.034	.028	.021	84	81	77	W.	W. by S	S. S. W.	21.48	15.42	7.82	......	......	Clear.	Clear.	Clear.
13	30.118	30.228	30.337	−13.9	6.9	−10.0	.120	.018	032	76	76	79	S	S. by W.	N. N. W.	8.41	1.48	0.80	......	......	"	"	"
14	318	100	201	−2.5	8.6	2.8	.032	.057	.044	83	88	86	N. E. by E.	N. E. by E.	N. E. by E.	10.95	2.92	6.27	......	0.70	Cu. Str. 10.	Cu. Str. 10.	Snow.
15	29.936	29.937	139	11.0	19.7	14.3	.062	.081	.072	89	77	88	S. W.	S. by W.	S. W.	26.96	7.30	4.60	......	......	" 10.	Clear.	Clear.
16	30.138	30.102	223	18.1	23.8	16.1	.084	.100	.074	90	80	83	S.	N. E.	N. E. by E.	1.00	0.01	0.08	......	......	" 10.	C. Str. 9.	Clear.
17	235	214	118	13.6	29.2	19.1	.063	.074	.087	80	69	83	N. E. by E.	N. E. by E.	N. E. by E.	0.00	3.50	12.08	......	......	Clear.	Clear.	Clear.
18	29.923	29.782	29.763	18.9	20.1	20.1	.088	.096	.096	85	84	84	N. E. by E.	N. E. by E.	N. E. by E.	11.41	15.62	15.06	......	4.40	Cu. Str. 10	Snow.	Cu. Str. 10
19	712	701	695	21.1	28.4	31.9	.096	129	.162	85	83	89	N. E. by E.	S. W.	S. by W.	17.20	0.88	1.85	......	0.20	Snow.	"	" 10.
20	740	600	410	30.0	34.1	38.3	.154	155	.224	91	79	90	S. W. by S.	N. E. by E.	N. E. by E.	7.40	0.21	5.41	......	0.90	Cu. Str. 10.	"	Snow.
21	500	627	796	20.1	21.1	10.9	097	.100	.058	92	85	80	W. S. W.	W. by S.	S.	3.30	11.72	23.07	......	1.70	" 10.	Cu. Str. 8.	Cu. Str. 2. [Zodiacal Light.
22	850	800	808	6.0	20.1	−0.2	041	.085	.034	74	83	80	S. by E.	S. S. E.	S. S. E.	6.99	1.62	1.40	......	......	" 4.	Clear.	Clear. Faint Aur. Borealis. Bright
23	681	580	573	6.0	22.8	19.0	.041	.095	.090	76	75	90	N. E.	S. E.	S. by E.	0.33	0.45	7.79	......	1.40	" 10.	Cu. Str. 10	Snow.
24	692	803	895	−10.0	−7.8	−16.9	.024	.021	.015	79	76	71	W.	W.	W. S. W.	25.56	0.10	4.50	......	......	" 2.	Clear.	Clear. Zodiacal Light, bright.
25	890	816	838	−20.1	−0.5	−4.0	.012	.023	.032	67	88	86	N. by E.	S. E.	N. E. by E.	0.50	0.01	6.17	......	0.75	" 10.	Cu. Str. 8.	Snow.
26	628	520	700	−6.4	5.6	6.6	028	.049	.048	81	87	88	N. E.	N. E. by E.	N. E.	21.36	6.70	6.20	......	1.06	Snow.	Snow.	Clear. Aurora Borealis.
27	30.076	30.270	30.397	−9.1	−1.3	−16.5	019	.034	.016	60	86	71	W.	N. W.	W.	19.60	11.05	7.32	......	......	Clear.	Clear.	Clear. Zodiacal Light visible.
28	460	440	633	−29.2	−0.5	−23.5	.007	.034	.010	53	80	60	W.	S. W.	N. W. by W.	0.42	0.00	0.00	......	......	"	"	Clear. Faint Aurora Borealis.
29	452	269	088	−32.6	−9.9	−14.6	.008	.017	.015	52	57	70	S. S. E.	E. S. E.	E. by S.	0.01	1.00	2.22	......	......	"	"	Clear.
30	29.781	29.710	29.700	−1.0	8.0	6.3	.031	.056	.051	80	82	87	N. E. by E.	E. by N.	S. W.	17.37	3.67	1.30	......	2.96	Snow.	Snow.	Cu. Str. 10.
31	907	823	965	3.2	9.0	2.8	.036	.046	.042	72	76	86	W.	W.	W. by S.	15.16	7.01	4.10	......	......	Cu. Str. 10.	Clear.	Cu. Str. 2.

REPORT FOR THE MONTH OF JANUARY, 1860.

Day of Month.	Barometer—corrected and reduced to 32° F. (English inches.)			Temperature of the Air.—F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.			Direction of Wind.			Horizontal Movement in 24 hours. (In Miles.)	OZONE. Mean amount of.	RAIN. Amount of, in inches.	SNOW. Amount of, in inches.	WEATHER, CLOUDS, REMARKS, &c. &c. [A cloudy sky is represented by 10, a cloudless one by 0.]		
	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.					6 a. m.	2. p. m.	10 p. m.
1	29.912	30.001	30.093	−12.0	−2.1	−16.9	.020	.034	.015	.76	.83	.79	W. N. W.	N. W.	W. by S.	5.80	0.6	......	......	Clear.	Clear.	Clear.
2	30.240	278	337	−21.9	−1.0	−13.0	.009	.028	.019	.40	.68	.70	W. by S.	W. by S.	W. by S.	172.60	1.0	......	......	"	Cu. Str. 7.	Clear.
3	439	241	105	−25.4	−14.2	−6.8	.008	.013	.026	.58	.51	.80	W. by S.	N. E. by E.	N. E. by E.	19.80	1.0	......	1.30	Cu. Str. 4.	" 10.	Snow.
4	29.930	29.926	135	−2.0	16.0	−2.0	.036	.067	.028	84	68	68	N. E.	N. E. by E.	W. N. W.	74.10	1.3	......	1.51	Snow.	Snow.	Cu. Str. 4.
5	30.313	30.298	298	−14.6	8.0	0.0	.017	.018	.038	70	77	55	W.	W. by S.	S. S. W.	104.70	1.6	......	......	Cu. Str. 4.	Clear.	Cu. Str. 10.
6	236	067	29.893	8.4	24.4	21.0	.037	.088	.085	88	67	78	S. W.	S. S. W.	S.	152.80	2.8	......	......	" 10.	Cu. Str. 10.	Cu. Str. 10.
7	29.874	29.681	583	19.2	33.4	36.9	.087	.182	.199	83	84	90	S.	S. by W.	W. S. W.	8.50	3.3	0.110	Inapp.	" 10.	Cu. Str. 10.	Rain.
8	597	630	723	32.4	38.8	37.0	.168	.201	.178	92	85	81	S. W. by S.	S. W.	W. N. W.	220.00	4.3	......	......	" 10.	Cu. Str. 10.	Cu. Str. 10.
9	30.165	30.049	30.073	21.0	28.9	20.9	.085	.123	.085	78	77	78	W. N. W.	S. W. by S.	N. E. by E.	116.10	0.6	......	......	Clear.	Clear.	Cu. Str. 10.
10	29.851	29.746	29.750	31.4	36.6	35.0	.068	.200	.197	95	93	94	S. by E.	E. by S.	S. by E.	69.40	8.3	Inapp.	2.11	Cu. Str. 10.	Rain.	Cu. Str. 10.
11	649	754	30.103	33.7	19.8	8.0	.182	.092	.046	94	92	85	W. by S.	N. E. by E.	W. N. W.	65.90	4.3	0.210	0.75	Rain.	Snow.	Cu. Str. 10.
12	30.107	30.158	29.843	−8.8	15.1	21.0	.028	.070	.085	81	81	78	N. by W.	S. W. by S.	S. W. by W.	152.80	1.0	......	......	Clear.	Cu. Str. 10.	Cu. Str. 9.
13	458	406	30.342	−24.6	−3.2	−8.7	.009	.025	.021	60	61	62	N. N. W.	E.	N. E. by E.	262.70	0.6	......	......	"	Clear.	Cu. Str. 10.
14	177	29.946	29.694	−8.4	2.0	7.0	.025	.036	.049	80	72	86	N. E. by E.	N. E. by E.	N. E.	114.40	1.0	......	0.75	Cu. Str. 10.	Clear.	Clear.
15	29.436	220	319	5.1	25.5	32.1	.041	.111	.182	74	81	89	N. E. by E.	W.	N. W. by N.	106.70	3.0	......	0.46	" 10.	Cu. Str. 8.	Cu Str. 10.
16	304	276	480	32.0	40.1	33.8	.168	.225	.182	89	90	84	W. S. W.	W. S. W.	W.	235.30	4.6	......	......	" 8.	Cu. Str. 9.	Clear.
17	694	719	785	10.1	12.0	0.0	.054	.051	.038	78	70	85	W.	W.	W.	169.50	2.6	......	......	" 8.	Clear.	Clear.
18	805	794	708	−12.2	6.0	3.0	.016	.043	.040	70	75	85	S. S. W.	N. E. by E.	N. E. by E.	61.30	1.0	......	0.60	" 4.	Cu. Str. 9.	Snow.
19	642	719	756	2.4	14.2	17.1	.040	.067	.078	86	80	81	N. E. by E.	W. S. W.	W. S. W.	172.20	1.3	......	1.00	" 10.	Clear.	Cu. Str. 10.
20	560	510	454	24.6	33.4	29.0	.105	.162	.142	80	84	88	W.	W. S. W.	S. E.	122.30	1.3	......	0.70	" 10.	Cu. Str. 4.	Cu. Str. 2. Aurora Borealis.
21	320	314	680	28.4	38.3	34.3	.129	.201	.190	83	86	93	W. S. W.	W. by N.	W. by S.	116.10	4.3	......	......	" 4.	Cu. Str. 10.	Cu. Str. 4.
22	691	497	614	24.2	31.9	29.1	.106	.148	.142	83	80	88	N. E. by E.	N. E. by E.	S. S. E.	197.50	2.3	......	......	" 10.	Cu. Str. 10.	Clear.
23	976	918	30.029	18.4	33.3	20.3	.072	.162	.084	82	84	80	W.	S. S. W.	S. by W.	166.10	3.0	......	......	" 4.	C. Cu. Str. 4.	Clear.
24	970	464	29.301	20.9	36.4	35.6	.097	.191	.197	85	90	95	S. S. E.	S. E. by E.	N. E. by E.	19.00	3.6	......	0.60	" 10.	Cu. Str. 10.	Cu. Str. 10.
25	280	314	639	33.2	32.2	22.1	.179	.167	.084	98	98	71	W. by S.	W. by S.	W. N. W.	549.20	5.0	0.140	......	Rain.	Cu. Str. 8.	Cu. Str. 8.
26	914	974	981	20.0	16.2	6.1	.091	.068	.048	85	76	75	W. by N.	W. by S.	S. W.	340.30	1.3	0.014	......	Clear.	Cu. Str. 4.	Clear.
27	979	709	794	−2.0	13.0	7.0	.034	.054	.050	84	71	88	S. S. E.	N. E. by E.	N. N. W.	22.80	2.0	......	......	"	Clear.	Cu. Str. 10.
28	775	594	904	1.0	12.2	0.5	.032	.045	.030	70	60	69	W.	W. by S.	W. by S.	132.90	1.0	......	0.52	Snow.	C. C. Str. 4.	Clear. Solar Halo.
29	30.057	880	615	−7.4	23.3	22.9	.024	.078	.098	79	69	79	W. S. W.	S. S. W.	S. by W.	84.80	2.0	......	......	Clear.	Clear.	Cu. Str. 10.
30	29.320	437	421	28.4	28.2	28.7	.129	.117	.129	82	75	82	W. N. W.	W by N.	S. S. W.	294.50	5.0	......	0.70	C. Str. 10.	Snow.	Cu. Str. 10.
31	942	30.067	30.239	2.0	0.0	−4.0	.034	.032	.031	71	70	83	W. by S.	W. N. W.	N. W.	453.30	3.0	......	1.00	" 6.	Cu. Str. 10.	Cirri 4. Lunar Halo.

REMARKS FOR DECEMBER, 1859.

Barometer .... Highest, the 3rd day, 30·728 inches.
Lowest, the 20th day, 29.410 "
Monthly Mean, 29.971 "
" Range, 1.316 "

Thermometer ... Highest, the 1st day, 42°1.
Lowest, the 29th day, —32°6.
Monthly Mean, 8°93.
Monthly Range, 74°7.

Greatest intensity of the Sun's rays, 38°0.
Lowest point of terrestrial radiation, —36°6.
Mean of humidity, .808.
Rain fell on 3 days, amounting to 1.480 inches; it was raining 26 hours and 20 minutes.

Snow fell on 14 days, amounting to 23.87 inches; it was snowing 150 hours and 30 minutes.
Most prevalent wind, the N. E. by E.
Least prevalent wind, the S.
Most windy day, the 4th day; mean miles per hour, 16.30.
Least windy day, the 28th day; mean miles per hour, 0.14.
Aurora Borealis visible on 3 nights.
Lunar Halo visible on 1 night.
Zodiacal Light visible and bright.
The Electrical state of the atmosphere has indicated high tension.
Ozone was present in large quantity.

REMARKS FOR JANUARY, 1860.

Barometer. .... Highest, the 13th day, 30.455 inches.
Lowest, the 21st day, 29.314 "
Monthly Mean, 29.861 "
Monthly Range, 1.141 "

Thermometer. Highest, the 16th day, 46°4.
Lowest, the 3rd day, —25°4.
Monthly Mean, 13°15.
Monthly Range, 71°8.

Greatest intensity of the Sun's rays, 66°4.
Lowest point of terrestrial radiation, —27°1.
Mean of humidity, 786.
Rain fell on 5 days, amounting to 0.474 inches; it was raining 24 hours 40 minutes.

Snow fell on 14 days, amounting to 11.90 inches; it was snowing 74 hours 40 minutes.
Most prevalent wind, the W. by S.
Least prevalent wind, the E.
Most windy day, the 25th day; mean miles per hour, 22.88.
Least windy day, the 1st day; mean miles per hour, 0.21.
Aurora Borealis visible on 1 night.
Solar Halo visible on 1 day.
Lunar Halo visible on 1 night.
The Electrical state of the atmosphere has indicated moderate intensity.

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THE

CANADIAN

NATURALIST AND GEOLOGIST.

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ARTICLE VIII. *Observations on the Natural History of the Valley of the River Rouge, and the surrounding Townships in the Counties of Argenteuil and Ottawa.* By W. S. M. D'Urban.

(*Continued from page* 276, *Vol. IV*)

INVERTEBRATA.

INSECTA.

COLEOPTERA.

Nearly all of the 114 species in the following Catalogue were obligingly determined for me by Dr. J. L. Leconte of Philadelphia. Besides those enumerated, many others were collected, but were unfortunately lost by the accidental fracture of the bottle which contained them.

I have added a list of 34 species, not observed in this district by myself, but brought by Mr. Robert Bell from the Augmentation of Grenville, and the neighbourhood of L'Orignal, on the south bank of the Ottawa.

Cicindela longilabris, Say.—Hamilton's Farm on the River Rouge, 2nd September.

" *vulgaris*, Say.—Very abundant on sand-banks, River Rouge, August.

* " *Baltimorensis*, Herbst. (*repanda*, Say.)—Common on sand-banks, River Rouge, July and August.

* The larvæ of this species were numerous in their burrows in the sand, by the side of the Rouge, five miles below Hamilton's Farm, 13th August.

Lebia viridis? Say.—Huckleberry Rapids, River Rouge, DeSalaberry, 30th July.

Patrobus longicornis, Say.—Sixteen-Island Lake, &c., Montcalm, May and June.

Platynus sinuatus, Dej.—Under dead logs, Sixteen Island Lake, &c., Township of Montcalm, May and June.

" *retractus*, Lec.—With the last species.

" *obsoletus*, Say.—With the last two species.

Pœcilus lucublandus, Say.—Under stones near the town of Grenville, 13th May.

Pterostichus fastiditus, Dej.—Under bark of decaying logs, Sixteen Island Lake, Montcalm, end of May; Lake of Three Mountains, end of September.

" *patruelis*, Dej.—River Rouge.

" *caudicalis*, Say.—Under stones near Grenville, 13th May.

" *orinomum*, Leach (*vitresis*, Esch.)—Township of Montcalm, June.

Luczotii, Dej. (var. præc?)—Sixteen Island Lake, Montcalm, May and June.

Lophoglossus mutator Lec.—Under stones near Grenville, 13th May.

Rembus major, Lec.— " " " "

Chlœnius impunctifrons, Say — " " " "

Cychrus (*Sphœroderus*) *Brevoortii*, Lec.—Under dead logs, Bevin's Lake, Montcalm, 4th July.

Notiophilus punctatus, Lec.—On rocks, Huckleberry Rapids, River Rouge, DeSalaberry, 27th July.

Bembidium impressum, Fabr.—On wet sand, River Rouge, 13th August.

" *punctatostriatum*, Say.—Very abundant on wet sand, River Rouge, July and August.

" *patruelis*, Dej.—Abundant on wet sand, River Rouge, 13th August.

" *lucidum*, Lec.—Under stones near Grenville, 13th May.

Agabus striatus? Say.—In Sixteen Island Lake, Montcalm, end of May.

Coptotomus interrogatus, Fabr.—In Sugar-bush Lake, Montcalm, 23rd June.

Hydroporus proximus, Aubé.—With the last species.

Haliplus immaculaticollis, Harris.—With the last two species.

" *cribarius*, Lec.—Very abundant in Sugar-bush Lake, Montcalm, 23rd June.

Gyrinus (several species not determined)—In various Lakes.

Dineutes (not named)—Very abundant, Sugar-bush Lake, Montcalm, 23rd June.

Philhydrus cinctus, Say.—In a small stream crossing the portage between Gate and Gut Lakes, Wentworth, and in Sugar-bush Lake, Montcalm.

Necrophorus lunatus, Lec.—Huckle-berry Rapids, River Rouge, DeSalaberry, 27th July.

" *pygmœus*, Kirby.—Township of Montcalm, 20th June.

Silpha marginata, Fabr.—Abundant under putrid fish, Sixteen Island Lake, Montcalm, 1st June.

Homalota, (not determined)—Township of Montcalm, June.

Tachyporus, (not determined) " " "

Tachinus fumipennis, Say.—In bear's dung, Chain Lake, Montcalm, 17th June.

" *conformis*, Dej.—Township of Montcalm, June.

Philonthus cyanipennis, Fabr.—In a fungus on a rotten tree, River Rouge, 13th August.

" (not determined)—Under stones near Grenville, 13th May.

Stenus (not determined)—Numerous on wet sand, River Rouge, Arundel, July.

" (not determined)—Numerous on wet sand, River Rouge, near Hamilton's Farm, 13th August.

Oxytelus Pennsylvanicus, Er.—Common in our tents throughout the district.

Anthobium dimidiatum, Mels.—Township of Montcalm, June.

Platysoma parallelum, Say.— " " "

Carpophilus niger, Er.— " " "

Epuræa, (not determined) " " "

Cucujus clavipes, Oliv.—One specimen taken as it pitched on the mane of a horse, Township of Harrington, 15th May.

Pediacus planus, Lec.—Very abundant in the tents, Huckle-berry Rapids, end of July.

Dermestes lardarius, Linn.—Observed about the provisions, Sixteen Island Lake, Montcalm.

Anthrenus castaneæ, Mels.—Township of Montcalm, June.

Platycerus depressus, Lec.—Near Huckleberry Rapids, River Rouge, DeSalaberry, July.

Onthophagus Hecate, Pz.—Near Huckleberry Rapids, River Rouge, DeSalaberry, 2nd August.

Geotrupes Egeriei, Germ. (*microphagus*, Say.) Woods near Hamilton's Farm, 31st August.

Aphodius fimetarius, Fabr.—Abundant in cow-dung, Hamilton's Farm, August.

Dichelonycha subvittata, Lec.—Abundant throughout the district, June to August.

Osmoderma scabra, Beauv.—River Rouge, July and August.

Nichius piger, Fabr.—On blossoms of *Viburnum opulus*, Sugar-bush Lake, and on white clover blossoms, and bleeding stumps of yellow birch, Bevin's Lake, Montcalm, end of June and beginning of July.

Ancylocheira maculiventris, Say.—Near Silver Mountain, River Rouge, 12th August.

Cryptohypnus silaceipes, Germ.—Under stones near Grenville, 13th May.

Dolopius fucosus, Lec.—Township of Montcalm, June.
" *stabilis*, Lec.— " " "
Corymbites triundulatus, Randall.—Township of Montcalm, end of May.
Pyractomena angulata, Say.—Common, Sugar-bush Lake, Montcalm, 23d to 26th June.
Ellychnia corrusca, Linn.—Under stones near Grenville, 13th May.
* " *lacustris*, Lec.—Abundant in the woods of Harrington, middle of May; Hamilton's Farm, and Lake of Three Mountains, August and September.
Digrapha terminalis, Say.—Bevin's Lake, 29th June, and 5th July, and Hamilton's Farm, 31st August.
Eros coccinatus, Say.—Sixteen-Island Lake, &c., Montcalm, end of May.
" *molis*, Lec.—Huckleberry Rapids, River Rouge, DeSalaberry, 2nd August.
Podabrus modestus, Say.—About clearings, Bevin's Lake, Montcalm, 2nd July.
Telephorus rotundicollis, Say.—Abundant " " "
" *carolinus*, Fabr.— " " " "
" *fraxini*, Say.—Township of Montcalm, June.
Anobium foveatum, Kirby.—Abundant in a rotten tree, Bevin's Lake, 4th July.
Cis. (not determined)—Township of Montcalm, June.
Pedilus collaris, Say.— " " "
Mordella nigricans, Mels.— " " "
Meloe rugipennis, Lec.—Hamilton's Farm, 31st August, and Grenville, 14th October.
†*Cistela* (not determined)—Very abundant on leaves of Bass-wood, Sugar-bush Lake, Montcalm, 26th June.
" (not determined)—River Rouge.
Nyctobates (not determined)—Under logs on grass-land, Hamilton's Farm, August.
Upis reticulatus, Say.—(*ceramboides*, Linn.)—With the last species.
‡*Bolitophagus cornutus*, Pz.—Larvæ and Pupa in a boletus, Huckleberry Rapids, DeSalaberry, 3rd August.
Apion, (not determined)—Township of Montcalm.
Sitona lepidus, Sch.—Near Hamilton's Farm.
Hylobius, (near *pineti*)—Sixteen Island Lake, 1st June.
" *pales*, Herbst.—Township of Montcalm, June.
Tomicus, (not named) " " "
Saperda tridentata, Oliv.—Base of Silver Mountain, Rouge, 10th Aug.
Monohammus confusor, Kirby,— " " " "

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* No Fire-flies were seen at night after the 19th of July. The Pupa of *Ellydinia lacustris* is as luminous as the perfect insect.

† This *Cistela* has a very rank scent.

‡ These larvæ were very active, wriggling about and jerking their abdominal segments with great force. One changed to Pupa, August 9; and a Pupa to Imago the same day. Another was evolved 13th August.

Monohammus scutellatus, Say.—Numerous, Bevin's Lake, 7th July; and abundant the whole way up the Rouge, to the end of August.

Encyclops cæruleus, Say.—One specimen taken on blossoms of *Viburnum opulus*, Sugar-bush Lake, Montcalm, 26th June.

Acmæops proteus, Kirby.—Township of Montcalm, June.

Evodinus monticola, Randall.—Sixteen-Island Lake, 30th May; and abundant on blossoms of *Viburnum opulus*, Sugar-bush Lake, end of June.

Leptura canadensis, Oliv.—Abundant on blossoms of *Spiræa salicifolia*, River Rouge, July and August.

" *vittata*, Oliv.—Near Huckle-berry Rapids, DeSalaberry, 15th July.

" *pubera*, Say.—Abundant on blossoms of *Viburnum opulus*, Sugar-bush Lake, Montcalm, 25th June.

" *proxima*, Say.—Near Huckleberry Rapids, DeSalaberry, 26th July.

" *mutabilis*, Lec.—On blossoms of *Viburnum opulus*, Sugar-bush Lake, end of June.

Donacia palmata, Oliv.—In blossoms of *Nuphar advena*, (Yellow Water-lily), Sugar-bush Lake, end of June.

" *subtilis*, Kunze.—In a small Lake near Lake of Three Mountains, 14th September.

" *pusilla*, Say.—Sugar-bush Lake, Montcalm, end of June.

" *flavipes*, Kirby.— " " "

Syneta tripla, Say.—Township of Montcalm.

Chrysomela scalaris, Lec.—Abundant on alders throughout the district, from the end of June to the end of September.

" *spirææ*, Say.—Very abundant, Sugar-bush Lake, 25th June.

" *interrupta*, Fabr.—Abundant on alders, Sixteen-Island and Sugar-bush Lakes, Montcalm, May and June. Larva abundant on alder leaves, June 25.

" *Vitellinæ*, Linn.—Abundant on oak and poplar leaves, Sixteen Island and Sugar-bush Lakes, May and June.

Systena pontalis, Fabr.—Township af Montcalm, June.

Phyllobrotica decorata, Say.—(*Oliviéri*, Kirby,)—Very abundant on *Scutellaria galericulata* and *lateripolia*, River Rouge, July and August.

Adoxus vitis, Fabr.—Amongst dead leaves, Gate Lake, Wentworth, 16th May.

Chrysochus auratus, Fabr.—Abundant on *Apocynum androsæmifolium* and *cannabinum*, Bevin's Lake, Huckleberry Rapids, &c., July.

Galleruca sagittariæ, Kirby.—Township of Montcalm, June.

Coccinella picta, Randall.— " " "

LIST OF SPECIES FROM L'ORIGNAL AND THE AUGMENTATION OF GRENVILLE.

Cymindis reflexa, Lec.
Calathus gregarius, Say.
Platynus capripennis, Say.
Pterostichus erythropus, Dej.
" *adjunctus*, Lec.
Amara angustata, Say.
" *impuncticollis*, Say.
Anisodactylus Baltimorensis, Say.
" *Harrisii*, Lec.
" *rusticus*, Say.
Harpalus Pennsylvanicus, Geer.
" *herbivagus*, Say.
Chlænius sericeus, Forst.
" *tricolor*, Dej.
Acilius fraternus, Harris.
Silpha Surinamensis, Latr.
Pæderus littorarius, Grav.
Hister perplexus? Lec.
Ips quadrisignatus, Say.
Cytilus varius, Fabr.
Lachnosterna fusca, Frolich.
Osmoderma eremicola, Knoch.
Photuris Pennsylvanica, Geer.
Trichodes, Nuttalii, Kirby.
Thanasimus dubius, Fabr.
Tenebris molitor, Linn.
Ipthinus Pennsylvanicus, Geer.
Orthosoma unicolor, Drury.
Saperda vestita, Say.
Chelymorpha cribaria, Fabr.
Haltica collaris, Fabr.
Chrysomela trimaculata, Fabr.
Helodes trivittata, Say.
Hippodamia 13-punctata, Linn.

LEPIDOPTERA.

With the exception of the *Rhopalocera* (Butterflies), the greater portion of the Lepidoptera collected are still undetermined. Some of the *Heterocera* (Moths) enumerated below, were named for me, at the British Museum, by Mr. Francis Walker, to whom I am much indebted. I obtained a great number of beautiful larvæ in October, but from the difficulty of transporting them from place to place, when travelling, I failed to rear any of them. From the end of May till August, *Noctuidæ* and *Geometridæ* swarmed at dusk in the woods, the light of our camp-fire often attracting them in great numbers into our tents, and the numerous delicate *Micro-lepidoptera* would have delighted Mr. Stainton.

Rhopalocera.

1. *Papilio turnus*, Linn., (Tiger Swallow-tail). Figured and described in the " Canadian Nat. and Geol.," Vol. 2, pl. 3, p. 223. Abundant throughout the whole of the district traversed. First observed 30th May, at Sixteen Island Lake, Montcalm, and became very numerous by the middle of June, continuing so until the beginning of July, at which time most of them were much worn, and they disappeared altogether by the end of the month. The beautiful apple-green larvæ were very abundant at the end of August and during the first week of September, at Hamilton's Farm on the River

Rouge. At that time we were camped on the grass of the clearing, under some scattered elm and ash trees, and the larvæ, which were numerous in the tents, appeared to have been blown out of these trees by the high winds, and were rapidly crawling about in search of a suitable place to spin their suspending girths, and undergo their transformations. Just before assuming the pupa state, they became dark brown in colour, with some lilac stripes and spots. On the 31st August, I met with a larva on an alder bush, across a leaf of which it had spun a bed of silk, and was reposing upon it in its usual manner, with the anterior segments drawn in and swollen out, so as to render the ocellated spots on the third segment very conspicuous. When in this position, these larvæ, if disturbed, rock themselves slowly from side to side, throwing out the forked orange tentacle, which is usually concealed from view in the segment behind the head, emitting at the same time a very acrid odour. The pupa is whitish-brown on the back and abdomen, with a darker line down the sides, and the wing-cases are dark brown, or black. This splendid butterfly frequently assembles in great numbers about wounds on the roots of trees from which sap exudes, and also about decaying fish and animal matter. On the shores of Sugar-bush Lake in the Township of Montcalm, on the 25th June, I counted fifty-six individuals crowded together in a space, not exceeding six square inches, where a dead cat-fish had lain for some time, and others were constantly ariving, flying straight to the spot against the wind, as though they had scented it from afar. On several occasions more than a dozen specimens were captured at a single grasp of the hand, having become so gorged and drowsy with their disgusting repast, as to be unable to fly.

2. *P. asterias*, Fab. (Black Swallow-tail.)—Figured and described in the "Canadian Nat. and Geol." vol. 2, pl. 3, p. 220. A large black butterfly seen by myself, as it sailed rapidly through the woods, on the borders of Chain Lake, Montcalm, 17th June, I supposed to be this species. It was not, however, again met with, which is not surprising, considering the scarcity of Umbelliferous plants in this district.

3. *Colias philodice*, Godt. (Clouded Sulphur.)—Figured and described in the " Canadian Nat. and Geol." vol. 2, pl. 4, p. 313. Numerous at Grenville on the 5th June, but I did not observe it again till the 30th of that month, after which it was not uncommon along the banks of the Rouge. At Hamilton's farm, 50 miles up

the river, it was quite numerous, especially in August and September. The last date at which I observed it there, was the 13th September, when it was still abundant, and I then captured a specimen apparently just evolved. I saw several individuals at Grenville, October 14th and 18th, and on my return to Montreal on the 19th of that month it was still rather numerous there. As the larva of this butterfly feeds on various species of *Trifolium* it is not to be looked for in uncleared districts, and in fact it is only to be seen around clearings and open places, where the clovers have been introduced either by accident or design.

4. *Pieris oleracea*, Harris (Grey-veined White). Described in the "Canadian Nat. and Geol." vol. 2, p. 347. Abundant throughout the whole district. First observed near Grenville, 14th May, and was then numerous in the woods of that township. It continued abundant up to the end of June, but was not seen afterwards till the end of August, when I observed a few worn individuals at Hamilton's Farm. This species also, had the habit of pitching upon the dead fish and offal lying round our camps, but never assembled in any great numbers.

5. *Danais Archippus*, Fab. (Storm Fritillary.)—Figured and described in the Canadian Nat. and Geol. vol. 2, pl. 6, p. 350. A single specimen, which appeared to have been recently evolved, was seen by myself, flying across the Rouge, a little above Silver Mountain, on the 12th August. The different species of *Ardepias*, which constitute the food-plants of the larva, are sparingly distributed in this district, and accordingly this butterfly is seldom met with.

6. *Satyrus** *Portlandia*, Boisd. (Pearly Eye.) First seen about the camp on the south side of Bevin's Lake, Montcalm, on the 2nd July, after which it was met with abundantly in the woods along the Rouge as far as Silver Mountain, near which on the 6th August, those seen were much wasted, and they soon afte entirely disappeared. The specimens collected agree tolerably accurately with Boisduval's figures and descriptions of *Satyrus Portlandia*. It is figured under the name of *Hipparchia Andromacha*. Hübner, in Say's "American Entomology," vol. 2, pl. 36, and in Gosse's "Canadian Naturalist" p. 246. In the latter work it is spoken of as very rare in the Eastern Townships, and Prof. T. P. Kirtland, says it is among the most rare of the butterflies of Ohio. Being generally supposed to be a southern species, it is not little remarkable that it should be so abundant

* (*Debis*.)

to the north of the Ottawa. I have also met with it near Montreal.

7. *Hipparchia nephele?* Kirby. Abundant amongst grass on Hamilton's Farm, from the 22nd August to the beginning of September, but all seen were much worn. It is a common species in hay-fields at Montreal and Sorel, and is described in "Fauna Boreali-Americana," p. 297.

8. *Limenitis Arthemis*, Drury. (Banded Purple). Figured in Gosse's "Canadian Naturalist" p. 220. First seen at Sugar-bush Lake, Montcalm, on the 26th June, after which it became the most abundant species and continued so until the end of July, when all observed were much worn, but lingered on till the middle of August. It frequently assembles in astonishing numbers round old lumbering camps, &c., congregating about the tea-leaves and other refuse lying about such places. On the 15th July, on the site of a lumbering camp and timber roll-way, on the banks of the Rouge, about three miles above the Indian Village in the Township of Arundel, I saw the most extraordinary assemblage of butterflies I ever beheld, several hundreds of this species being congregated together in groups consisting of from twenty to fifty individuals in each, whilst many others flew around and rendered it difficult to arrive at an accurate estimate of their numbers; nevertheless I am convinced that I am within the mark, when I state that there were more than three hundred assembled within a space of a few square yards. This species is very restless and active when on the ground, constantly opening and shutting its wings, unrolling its tongue, and running to and fro very rapidly, and even when feeding is not easily surprised. It flies freely in cloudy weather and quite late in the afternoon. According to Prof. Kirtland it is a rare species in Ohio.

9. *Cynthia cardui*, Linn. (Painted Lady). Described in the "Canadian Nat. and Geol." vol. 3, p. 346. But one specimen was met with, which was on the 21st August, at Hamilton's Farm, where the common thistle (*Cirsium lanceolatum*), the food-plant of its larva, is plentiful about the fields.

10. *Vanessa Atalanta*, Linn. (Red Admiral). I observed a butterfly which appeared to be of this species, on the 24th June, at Sugar-bush Lake, Montcalm.

11. *V. Antiopa*, Linn. (Camberwell Beauty). Figured and described in the "Canadian Nat. and Geol.," vol. 2, p. 93. Rather common at Grenville on the 13th May; a few specimens were seen

in the Township of Montcalm in June, and near Silver Mountain on the Rouge, on the 12th of August.

12. *V. Milberti*, Godt. *furcillata*, Say. (Forked). Common at Grenville, 14th May, not seen again until July 10th, on the Rouge, after which it was observed occasionally at Hamilton s Farm, up to the 31st August.

13. *V. J. album*, Boisd. (Compton Tortoise). A common species throughout the district, from the 19th May to the end of September. I observed one near Grenville on the 18th October.

14. *Grapta Progne*, Fab. (Green Comma). Abundant everywhere from the 14th May to the middle of September. On one occasion an individual of this species pitched on my hand and I caught it between my fingers.

15. *G. C. album*, Godt. (Orange Comma). The species of the genus *Grapta* (popularly termed Commas, from the silver spots in the centre of the hind-wings on the under side, which resemble an inverted comma) are so subject to variation, that it is extremely difficult to determine them, unless they are reared from the larvæ. I, however, took several specimens of a species which I believe to be *G. C. album* along the Rouge in July and August.

16. *Argynnis Daphnis*? Cramer (Small Silver-spot Fritillary). First seen at Bevin's Lake, Montcalm, 2nd July, andfrom that date it was abundant all the way up the Rouge as far as Hamilton's Farm, at which place, on the 25th of August, I saw a specimen perfectly fresh, whilst many others were flying about in a worn condition. It was very numerous on the flowers of *Asclepias incarnata*, near the Indian Village on the 18th July. The last date at which it was observed by me was 12th September. I am of opinion that Boisduval was in error in considering *A. Aphrodite*, Fab., and *A. Cybele*, Fab. as one and the same species. There are at least three closely allied species of *Argynnis* inhabiting Canada, but nothing short of breeding each from the larvæ will satisfactorily separate them. Two of my specimens agree best with Cramer's figure of *A. Daphnis*, but a third differs considerably and may be another species. They are all too small for *A. Cybele*, Fab.

17. *A. Myrina*, Cramer. (Pearl-border Fritillary). First seen at Grenville 5th June. Common at Bevin's Lake, Montcalm, at the beginning of July, and at Hamilton's Farm up to the 31st August.

18. *A. Bellona*, Fab. One specimen taken near Mr. Thompson's clearing on the Rouge, in the Township of Arundel, on the 30th June. It was not again met with.

19. *Melitæa Tharos*, Cramer, *Cocyta*, Hübner, (Pearl-crescent Fritillary). First observed at Sugar-bush Lake, Montcalm, 29th June. *In copula* and rather worn 2nd July about Bevin's Lake. A few seen a few miles up the Devil's River, 14th July.

20. *Thecla* (?) A large *Thecla* was seen by me at the Huckleberry Rapids on the Rouge, 2nd Range of De Salaberry, on the 30th July, but I failed in my attempts to secure it, and could not recognise the species, nor did I meet with any other of this genus.

21. *Lycæna Americana*, Harris (American Copper). Numerous from the 21st to the 31st August, on grass-land at Hamilton's Farm, where its food-plant, the sorrel (*Rumex acetosella*), abounds.

22. *Polyommatus pseudargiolus*, Boisd. (Spring Azure). Numerous on the 14th May, in the woods of the Township of Grenville. The males were extremely abundant, congregating round putrid fish on the shores of Sixteen-Island Lake, at the end of May; I saw worn specimens as late as the 2nd July, about Bevin's Lake. When in a canoe on Sixteen-Island Lake, one of these beautiful little butterflies pitched on my hand and remained there for some time.

23. *Pamphila* (?) Two specimens of a dingy grey species of Shipper were captured, one at Sugar-bush Lake, June 26th, and the other at Bevin's Lake, 2nd July.

24. *Pamphila* (?) One specimen of a *Pamphila*, resembling *P. paniscus* (Chequered Shipper) of Europe, was taken near Bevin's Lake, Montcalm, 2nd July.

Two or three other species of *Pamphila* were taken in the Townships of Montcalm and Arundel, and at Hamilton's Farm, in June, July and August, which I have been unable to determine, and which are probably undescribed species.

Heterocera.

SPHINGINA.

Sphinx. I captured two species of *Sphinx* on the Rouge, in the Townships of Arundel and DeSalaberry, in July, allied to *S. kalmiæ*, Abbot and Smith, and *S. gordius*, Cramer, but not agreeing satisfactorily with the descriptions of those species as given by Dr. Harris in his Catalogue of American Sphinges, (Amer. Jour.

Sci. vol. xxxvi). According to Mr. Walker, neither of them is in the collection of the British Museum. Dead fish appear to be very attractive bait for Sphinges as well as other Lepidoptera, one of the species above mentioned having been taken whilst hovering over a dead carp lying by the water side, and many others were seen under similar circumstances. On the 11th August, when camped on a low flat at the base of Silver Mountain on the Rouge, I obtained a *Sphinx* larva, which from my notes, appears to have resembled that of *S. Kalmiæ*, as described by Harris (vide Amer. Journ, Sci. vol. xxxvi, p. 295). It was light green, with seven oblique yellow stripes edged above with dark purple, on each side; head yellow, with a vertical band of dark brown on either side; caudal horn, blue, covered with small black tubercles, and tipped with black. It appeared to have been washed by the heavy rain which had just fallen during a violent thunder storm, from the soft maples (*Acer rubrum*), which almost exclusively surrounded the tents, and on one of which it was crawling. Another splendid larva was found on the 19th September, feeding on a bush of *Myrica gale*, growing on the shores of Green Lake, adjoining the Lake of Three Mountains, in the county of Ottawa, about five miles from Hamilton's Farm. The following is the description of it which I made at the time: "Deep olive-green, covered with minute spots of white, edged with black; seven oblique pink stripes, edged above with black and below with pale yellow, on either side; caudal horn, black; spiracles, orange; pro-legs, yellow; a stripe of light green on each side of the head." The minute white spots surrounded by black, thickly covering the whole upper surface, gave it a striking and most interesting resemblance to the scurfy resinous dotted leaves of its food-plant, the Bog Myrtle or Sweet Gale. This beautiful larva changed to a pupa which unfortunately perished during the following winter.

Smerinthus. I obtained two larvæ, belonging to this genus, under elm trees at Hamilton's Farm, on the 3rd and 4th September, of which the following are descriptions: No. 1, pale green, whitish on the back, with oblique stripes of white and dark green on the sides. No. 2, green, with oblique tuberculated stripes on the sides, and two tubercles on each of the second and third segments.

Trochilium. On the 25th June, at Sugar-bush Lake, I captured a beautiful and apparently undescribed species of *Trochilium*, sitting on the blossoms of *Viburnum opulus* which were

much frequented by insects of all orders. The anal tuft is deep orange; antennæ, black; expansion of thewings 11 lines; length of the body 5 lines.

BOMBYCINA.

1. *Ctenucha Latreillana*, Kirby. (Cœrulean). Described in "Fauna Boreali-Americana," p. 305. One specimen taken on the 16th July, near the Indian Village on the Rouge, Township of Arundel.

2. *Crocota brevicornis*, Walker. Described in "British Museum Catalogue Lepid. Het." part II, p. 535. Observed in open places at Huckleberry Rapids, DeSalaberry, and numerous amongst grass at Hamilton's Farm, end of July and August.

3. *Medaria Mendica*, Walker. (Buff Muslin). Described in "British Museum Cat. Lepid. Het." Part II, p. 576. Not abundant in this district, but occurred near Bevin's Lake, Montcalm, in July.

4. *Arctia Parthenos*, Harris (Great Northern Tiger). On the 19th July, five miles up the Devil's River, a tributary of the Rouge, I took a fine *Arctia* agreeing in every respect with the figure and description of *A. Parthenos*, given by Dr. Harris in Agassiz's "Lake Superior," p. 390, pl. 7, fig. 4, with the exception that it has *five*, instead of *three* cream-coloured spots on the costal edge of the anterior wings.

5. *Hypercompa Lecontei*, Boisd. (White Tiger). Occurred at various places in the Townships of Montcalm, Arundel and DeSalaberry, during the month of July. *H. confinis* and *contigua*, Walker, ("Brit. Mus. Cat. Lepid. Het." part III, p. 651), appear to be merely varieties of this very variable species.

6. *Halesidota annulifascia*, Walker. Described in Brit. Mus. Cat. Lepid. Het. part III, p. 733. I found cocoons of a Muff Moth under stones, 22nd May, near Sixteen Island Lake, Wentworth, most probably belonging to this species, which abounds near Montreal. Mr. Walker's *H. annulifascia* appears to me to be identical with *Sophocanipa Caryæ* (Hickory Jussock Moth) of Harris, (vide Fitch's "Noxious Insects of New York," p. 163).

7. *Orgyia leucostigma*, Abbot and Smith (American Vapourer). Vide Fitch's "Noxious Insects of New York," p. 213. The males were numerous flying in the sunshine at Hamilton's Farm, at the end of August and beginning of September.

8. *Telea Polyphemus*, Hübner, (Eyed Emperor). Abundant at the end of June and beginning of July, about Bevin's Lake, Township of Montcalm. I also found numerous empty cocoons, near Sixteen Island Lake, Wentworth, and at Huckleberry Rapids, DeSalaberry, and the beautiful larva, (vide the excellent figure in Gosse's "Canadian Naturalist," p. 309,) was common on elm trees at Hamilton's Farm, being full grown and spinning up at the end of August. This fine species is therefore distributed over the whole district traversed. These gigantic Emperor Moths have a very strange appearance when seen against the clear sky of a fine summer evening, as they fly over the lakes.

NOCTUINA.

1. *Thyatira scripta*, Gosse. (Pink Arches). Figured in Gosse's "Canadian Naturalist," p. 249. This most beautiful species was abundant in the Townships of Montcalm and Arundel, at the end of June and the beginning of July.

2. *T. cymatophoroides*, Guén. Common at Sugar-bush and Bevin's Lakes, Montcalm, and mouth of Devil's River, Arundel, at the end of June and July; also at Trembling Mountain Lake, Grandison, 7th September.

3. *Graphiphora C. nigrum*, Linn. One specimen taken at Huckleberry Rapids, DeSalaberry, 24th July; and another worn one at Hamilton's Farm, 28th August.

4. *G. Dahlii*, Hübner. One specimen taken near Gate Lake, Wentworth, 17th May.

5. *Euplexia lucipara*, Linn. (Small Angleshades)—Common in the Township of Montcalm in June.

6. *Plusia mortuorum*. Abundant flying by day at Hamilton's Farm in the end of August.

GEOMETRINA.

1. *Angerona crocataria*, Fab. (Lemon beauty). Common in the Townships of Montcalm and Arundel, frequently flying by day in July. The female of this species is much larger, and paler in colour than the male.

2. *Sicya solfataria*, Guén. This lovely little moth was not uncommon at the end of July, in the Township of DeSalaberry. It bears a great resemblance in colour, markings, and form to *Ennomos macularia*, Harris. (Vide Agassiz's "Lake Superior," p. 392, pl, 7, fig. 3.)

3. *Ellopia æqualiaria.* Township of Montcalm, June.

4. *Nematocampa filamentaria*, Guén. Huckleberry Rapids, 2nd Range, DeSalaberry, 27th July.

5. *Endropia tigrinaria*, Guén. Very abundant in the Township of Montcalm at the end of June.

6. *Melanippe gothicata*, Guén. Extremely numerous, especially in rocky woods, in the Township of Montcalm, during the month of June. It flies in such a manner that the white bands across the wings appear to form a complete circle in the air. It is closely allied to *M. hastata* of Europe.

7. *Scotosia undulata*, Linn. (Scallop Shell). Common in the end of June and the beginning of July in the Township of Montcalm. Those collected are exactly similar to English specimens.

PYRALIDINA.

1. *Pyralis*, n. sp? Huckleberry Rapids, DeSalaberry, 27th July. Mr. Walker supposes this to be a new species, and the following is a description of it:—Anterior wings, dull pink, crossed by two black transverse lines, the first of which, situated near the base, is straight, and has a yellow spot on the inner side, occupying the angle which it forms with the costa; the second, situated beyond the middle, is bent, forming an obtuse angle before it reaches the costal margin, where it has a yellow crescent-shaped spot on the outer side. Posterior wings, dusky-white at the base, with a broad, pale black, sub-marginal band and crossed by two black transverse lines. Expansion of the wings 12½ lines; length of body 4 lines.

2. *Bleptina surrectalis*, Guén. Huckleberry Rapids, DeSalaberry, 4th August.

3. *Anania octomaculata*, Linn. (White spot). One specimen taken on the 2nd July, near Bevin's Lake, Montcalm. It occurs also on the northern shores of Lake Superior and in Europe.

4. *Hydrocampa.* A species of *Hydrocampa* was abundant, flying over aquatic plants in a small lake near Hamilton's Farm, 15th August.

5. *Botys verticalis*, Linn. (Mother of Pearl). Not uncommon at Huckleberry Rapids, DeSalaberry, about the 1st of August. Those collected have been compared with British specimens and appear to be identical.

6. *Eubulea.* A small species apparently closely allied to the European *E. sambercalis*, Schiff., was very numerous on the blos-

soms of the Raspberry, (*Rubus strigosus*) near Bevin's Lake, Montcalm, at the beginning of July.

TORTRICINA.

Tortrix. On the 19th July, five miles up the Devil's River, I found a mass of web, spun by larvæ, over the leaves and branches of the Indian Hemp (*Apocynum cannabinum*), which was full of pupæ of a *Tortrix*, and at the end of the month, those I collected, produced the perfect insect, but I have been unable to determine either this or any other of my *Miero-Lepidoptera.*

MOLLUSCA.

Some of the Terrestrial Gasteropoda, enumerated below, were determined by W. G. Binney, Esq., of Burlington, New Jersey, and a portion of the Fresh Water species, and the *Naiades*, by Dr. Isaac Lea, of Philadelphia. It is not a little remarkable that *Unio radiatus*, which, as I am informed by Messrs Billings and Bell, is very abundant in the Ottawa at L'Original, and at the mouth of the Rouge, is not found higher up the latter river. Shells of the genera *Limnæa*, *Physa* and *Planorbis*, were remarkably scarce in every lake except Sugar-bush Lake, Montcalm, and a small lake one mile west of the Indian Village on the Rouge in the Township of Arundel, and in fact it was only in places where the water was shallow and the bottom soft that they occurred at all. The valves of the *Unio* and *Anodontæ* were very much eroded in most of the lakes.

GASTEROPODA. (*Terrestrial.*)

1. *Tebennophorus caroliniensis*, Bosc. (Great grey Slug)—Common under bark of decaying logs, &c., throughout the district.
2. *Succinea obliqua*, Say.—Abundant under decaying logs on grass-land at Hamilton's Farm, in August. It occurred very sparingly on the leaves of bushes, in other parts of the district.
3. *Helix albolabris*, Say (White-lipped Snail).—Not very common; Township of Wentworth, Montcalm and Harrington.
4. " *exoleta*, Binney.—Not uncommon under dead logs in the Townships of Wentworth, Harrington and DeSalaberry.
5. " *monodon*, Rackett. (One-toothed Snail.)—Sparingly met with; portage from the Indian Village to Bark Lake, Arundel; Hamilton's Farm and near the Lake of Three Mountains.
6. " *concava*, Say.—Abundant under dead logs; Townships of Wentworth, Montcalm and Arundel. On one occasion I found an individual of this species devouring the animal of *Achatina lubrica*, having made a hole through the spire of its shell

7. *Helix pulchella*, Müll.—Occurred under stones at Carillon, but was not elsewhere met with.
8. " *Sayii*, Binney.—Several specimens were found by myself under dead logs in the woods near Doran's Lake, in the 10th Range of Grenville.
9. " *labyrinthica*, Say.—Common under dead logs, bark of stumps, in moss on the trunks of trees, &c.; Townships of Wentworth, Montcalm and Arundel.
10 " *alternata*, Say.—Abundant throughout the district, under dead logs and ascending the trunks of trees after rain.
11. " *striatella*, Anthony.—Very abundant under stones and dead logs everywhere throughout the district.
12. " *arborea*, Say.—Plentiful under bark of decaying trees, &c., throughout the district.
13. " *chersina*, Say.—Common under dead logs, &c., over the whole district.
14. " *lineata*, Say.—Abundant throughout the district.
15. *Bulimus marginatus*, Say.—Near Gate Lake, Wentworth, and Sugar-bush Lake, Montcalm.
16. *Achatina lubrica*, Müll.—Common under dead logs near Gate Lake, Wentworth, and Bevin's Lake, Montcalm.
17. *Vertigo Gouldii*, Binney.—In moss (*Neckera pennata*) on tree trunks; Sixteen Island Lake, Montcalm.
18. *Pupa* (undetermined)—With the last species.
19. *Carychium exiguum*, Say.—One specimen found near Sixteen Island Lake.

(Fresh Water.)

20. *Physa heterostropha*, Say.—Pools on grass near Grenville, and Sugar-bush Lake, Montcalm.
21. " *aurea*, Lea.—Sparingly in a small lake near Hamilton's farm.
22. " *elliptica*, Lea.—In a small lake one mile west of the Indian Village, Arundel; collected by Mr. J. Lowe.
23. " *elongata*, Say.—In great numbers copulating in pools on grass, near Grenville, May 13th.
24. *Limnæa reflexa*, Say.—Abundant in pools of water on grass land near the Village of Grenvile, May 13th.
25. " *umbilicata*, Say.—With the last species.
26. " *galbauns*, Say.—Abundant in shell marl from the bottom of Eagle Nest Lake, Wentworth.
27. " *plicata*, Lea.—This small species was numerous on dead leaves in Sugar-bush Lake, Montcalm, June 26th.
28. " *exigua*, Lea. (young)—In a small lake near Hamilton's farm.

29. *Planorbis trivolvis*, Say.—Collected by Mr. J. Lowe, in a small lake one mile west of the Indian Village on the Rouge, Township of Arundel.

30. " *bicarinatus*, Say.—In shell marl, and living in Eagle Nest Lake, Wentworth, and in a small lake near Hamilton's farm.

31. " *companulatus*, Say.—Pools near Grenville; Eagle Nest Lake, Wentworth; a small lake west of Chain Lake (a few dead specimens full of minute holes); Sugar-bush and Bevin's Lakes, Montcalm; the lake one mile west of the Indian Village, Arundel; and in a small lake near Hamilton's farm.

32. " *parvus*, Say.—Abundant in shell marl, Eagle Nest Lake, Wentworth; living in the lake one mile west of the Indian Village, and in one near Hamilton's farm.

33. " *deflectus*, Say.—Abundant amongst decaying leaves in shallow and muddy parts of Sixteen Island and Sugar-bush Lakes, Montcalm.

34. *Paludina decisa*, Say.—Very abundant the whole way up the Rouge and its tributary the Devil's River. Those collected are of a reddish brown colour, very unlike the light green of specimens from L'Orignal opposite the mouth of the Rouge, or those from the St. Lawrence near Montreal. They were encrusted with a rusty-red sponge-like substance.

35. *Valvata tricarinata*, Say.—A few specimens found in shell marl from the bottom of Eagle Nest Lake, Wentworth.

Conchifera (*Fresh Water.*)

1. *Unio complanatus*, Lea.—This was the only species of *Unio* met with. It inhabits nearly every lake in the district and was abundant the whole way up the Rouge as far as we ascended. In shallow and muddy parts of Sixteen Island Lake it attains a considerable size and weight, but in the other lakes and in the Rouge the specimens were generally rather small. It was most numerous in the stream through which the waters of Bevin's and Bark Lakes are discharged into the Rouge, where, in shallow places, thousands might be seen buried in the mud with only the tips of their valves sticking out, and as thick as they could lie together. The specimens collected vary much in shape, and in the colour of the interior of the valves, which, except those from Bevin's Lake, have hardly any of the beautiful purple colour generally possessed

by this species as it occurs in the St. Lawrence and Ottawa. The muskrats devour vast numbers both of this species and of the *Anodontæ*, depositing their empty valves in large heaps on the shores of the lakes and streams.

2. *Alasmodon rugosus*, Barnes.—One specimen obtained in the fourth small lake* west of Balsam or Chain Lake, Lot 11, Range 3, Montcalm.
3. *Anodonta cygnea?* Linn.—This species was found in almost every lake we visited. The largest specimen met with was obtained from a small lake occupying part of an ancient channel of the Rouge, near Hamilton's farm, and measured $4\frac{3}{4}$ inches in length and $2\frac{1}{8}$ inches in height.
4. " *edentula*, Say.—One specimen obtained by Mr. J. Murray, at the same time with the specimen of *Alasmodon rugosus* in the lake situated in the 11th Lot, 3rd Range, Montcalm.
5. " *fragilis*, Linn.—Eagle Nest Lake, Wentworth; Sixteen Island and Bevin's Lakes, Montcalm.
6. " *Footiana*, Lea.—With the last species.
7. *Cyclas similis*, Say.—Living in Sixteen Island and Sugar-bush Lakes, Montcalm; in a small lake one mile west of the Indian Village, Arundel; and in shell marl in Eagle Nest Lake, Wentworth.
8. " *partumeia?* Say.—Young specimens amongst dead leaves in ponds near Eagle Nest Lake, Wentworth; in Sugar-bush Lake, Montcalm; and the small lake near Hamilton's farm.
9. " *dubia?* Say.—In shell marl, Eagle Nest Lake, and living in the small lake near Hamilton's farm.

Exeter, Devonshire, January 30, 1860.

* This lake communicates by a rapid stream with Sugar-bush Lake, which is connected with Bevin's Lake, and the latter is in direct communication with the Rouge by a large creek about two miles in length. The difference in level between these lakes and the Rouge is only a few feet, but there is a very considerable rise between them and Chain and Sixteen Island Lakes, which also empty their waters into Bevin's Lake, but by a very circuitous route. Bevin's Lake rises about 12 feet in spring when the snow disappears.

ARTICLE IX.—*Review of "Darwin on the Origin of Species by means of Natural Selection."**

Nothing is more humbling to the scientific enquirer than to find that he has arrived in the progress of his investigations at a point beyond which inductive science fails to carry him. The physicist finds himself in this position when required to explain the nature of matter, or the cause of gravitation or cohesion, or the essence of the mysterious influences of light, heat, and electricity. The chemist is equally baffled in the presence of those mysterious atoms which are in all his processes, yet are not perceptible to his senses The physiologist stands awe-stricken in the presence of a microscopic cell whose structure he knows, but whose origin and wonderful vital endowments he fails to comprehend. The geologist and the systematic zoologist are haunted in their dreams by those multifarious species that appear and disappear, like phantoms on the stage of geological time, yet seem so fixed and unchangeable in existing nature. True science is always humble, for it knows itself to be surrounded by mysteries—mysteries which only widen as the sphere of its knowledge extends. Yet it is the ambition of science to solve mysteries, to add one domain after another to its conquests, though certain to find new and greater difficulties beyond. Hence we find every difficult problem assailed by a constant succession of adventurers, some of them content cautiously to explore the ground and prudently to retreat where to advance is no longer safe; others gathering all their strength for a rush and a leap into an unknown and fathomless abyss. Both classes do good to science. The first show us the real nature of the difficulties to be overcome or to be abandoned as hopeless. The second we follow to the last crumbling margin of sound fact and deduction on which their feet have rested before their final plunge, and thus gain an experience that otherwise we should not have had the courage to seek.

The question of the origin of species yields in difficulty to none of the problems to which we have referred above, and Mr. Darwin's book is a noted instance of the second of the methods of

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* *On the Origin of Species by means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life;* by CHARLES DARWIN, M.A. 1 vol. post 8vo. pp. 502. London: John Murray. New York: Appletons. Montreal: Dawson. 1860.

treatment which we have indicated. We do not however value him the less on account of his boldness and rash self-sacrifice in the cause of science. We follow him with pleasure over many agreeable and instructive paths not previously explored, and we shrink back only when he leads us to the brink of a precipice, and we fail to perceive the good land which he says lies beyond, or to place confidence in the bridge, thinner than gossamer, which he has woven to bear our feet over the gulf that separates the proved ground of specific variability from the mystery of specific difference. We regard this as the most accurate and concise statement that can be made respecting the character of this book. It elaborately investigates the question of variation of species, and illustrates its laws in a very full and satisfactory manner, though giving to some of these laws an undue prominence as compared with others. It then attempts to apply the laws of variation to an entirely different series of phenomena, those of specific diversity, and finding some analogies between the characters that distinguish species and varieties, seeks on this ground to break down all specific distinction in respect to origin, and to reduce all species to mere varieties of ancient and perhaps perished prototypes.

The work thus divides itself naturally into two distinct and quite dissimilar portions: 1st. The careful induction of facts bearing on the nature and laws of variation, in which the author appears in all his strength as a patient and reliable zoologist; and, 2nd. The wild and fanciful application of the results thus attained to another class of phenomena with which they have no connection except that of mere analogy. We shall endeavor to distinguish these two portions of the work, but cannot avoid treating of them together.

Variation occurs under two very different conditions. It takes place in domesticated animals and plants, and in animals and plants in a wild state. Very properly our author first examines its conditions under domestication, in which state variation is much more extensive and also more easily observed. The great variations that occur in a state of domestication are no doubt due to changed and unnatural conditions of life; but farther than this we know nothing of their precise causes. On this subject our author indulges in some preliminary speculations, and tries to rid the subject of what he terms misconceptions, some of which are, however, only facts too stubborn to be bent to his theory. For example, in speaking of the prevalent idea, that domesticated

animals have been chosen by man on account, among other things, of their capacity for variation, he says :—"I do not dispute that these capacities have added largely to the value of some of our domesticated productions; but how could a savage possibly know when he first tamed an animal whether it would vary in succeeding generations, and whether it would endure other climates? Has the little variability of the ass or the guinea-fowl, or the small power of endurance of warmth of the reindeer or of cold by the common camel, prevented their domestication? I cannot doubt that if other animals and plants equal in number to our domesticated productions, and belonging to equally diverse classes and countries, were taken from a state of nature, and could be made to breed for an equal number of generations under domestication, they would vary on the average as largely as the parent species of our existing domesticated productions have varied." On reading these sentences it must occur to any reflective reader, 1st. That savages very rarely tame animals. 2d. That if savages or others attempted to tame animals indiscriminately, they would fail in many cases, and these in the very cases in which species could endure little change. 3d. Animals little variable, like the reindeer and the camel, have little geographical range, and this just because of the fixity or tenderness of their constitution. 4th. Even the capacity of breeding at all under the changed conditions of domestication, is wanting in some species. In short, there is no reason whatever to believe that species are equally variable; but, on the contrary, that they differ very much in this respect,—as naturalists have always maintained. In the same loose way he treats the doctrine of the tendency of varieties to revert to the original types of the species. This, our author admits, if established, would overthrow his whole hypothesis, and he gets rid of it by denying the evidence of reversion afforded by so many of our domestic animals and cultivated plants, and by farther affirming that such reversion, if it does occur, amounts to nothing, because produced by external causes. Certain species, by the external causes applied in domestication, are caused to vary. These causes being removed, as every one knows, they gradually lose their acquired and unnatural characteristics; but, according to Mr. Darwin, this gives no evidence of an original type, but only of the operation of other causes of change, tending in some other direction. The argument would be good if we could have species destitute of all distinctive characters to begin with; in

other words, if we could create species. But as the case stands, it is a mere *petitio principii.*

In this way our author, in the opening paragraphs of his first chapter, quietly ignores a number of facts essential to the validity of the received views of species, and so leads the unwary reader to enter on the consideration of variation with an impression already formed that varieties and species are not distinguishable. We take the liberty of entering on the enquiry in another spirit, and of beginning with the fact that we have species which have remained distinct in the whole period of human experience, and also as far back in geological time as we can trace any of them. This being premised, we may enquire what variations man has been able to effect in those species which he has domesticated, and by what processes and under what laws these changes have occurred.

These changes have been very great. Mr. Darwin has studied the domestic pigeon as a convenient instance, and his investigations on this animal are worthy of all praise, and establish most clearly the great amount of variation of which some species are susceptible. We quote this in full, as the most valuable portion of the book:—

"Believing that it is always best to study some special group, I have, after deliberation, taken up domestic pigeons. I have kept every breed which I could purchase or obtain, and have been most kindly favoured with skins from several quarters of the world, more especially by the Hon. W. Elliot from India, and by the Hon. C. Murray from Persia. Many treatises in different languages have been published on pigeons, and some of them are very important, as being of considerable antiquity. I have associated with several eminent fanciers, and have been permitted to join two of the London Pigeon Clubs. The diversity of the breeds is something astonishing. Compare the English carrier and the short-faced tumbler, and see the wonderful difference in their beaks, entailing corresponding differences in their skulls. The carrier, more especially the male bird, is also remarkable from the wonderful development of the carunculated skin above the head, and this is accompanied by greatly elongated eyelids, very large external orifices to the nostrils, and a wide gape of mouth. The short-faced tumbler has a beak in outline almost like that of a finch; and the common tumbler has the singular and strictly inherited habit of flying at a great height in a compact flock, and

tumbling in the air head over heels. The runt is a bird of great size, with long massive beak, and large feet; some of the sub-breeds of runts have very long necks, others very long wings and tails, others singularly short tails. The barb is allied to the carrier, but, instead of a very long beak, has a very short and very broad one. The pouter has a much elongated body, wings, and legs; and its enormously developed crop, which it glories in inflating, may well excite astonishment and even laughter. The turbit has a very short and conical beak, with a line of reversed feather down the breast; and it has the habit of continually expanding slightly the upper part of the œsophagus. The Jacobin has the feathers so much reversed along the back of the neck that they form a hood, and it has, proportionally to its size, much elongated wing and tailfeathers. The trumpeter and laugher, as their names express, utter a very different coo from the other breeds. The fantail has thirty or even forty tailfeathers, instead of twelve or fourteen, the normal number in all members of the great pigeon family; and these feathers are kept expanded, and are carried so erect that in good birds the head and tail touch; the oil-gland is quite aborted. Several other less distinct breeds might have been specified."

"In the skeletons of the several breeds, the development of the bones of the face in length and breadth and curvature differs enormously. The shape, as well as the breadth and length of the ramus of the lower jaw, varies in a highly remarkable manner. The number of the caudal and sacral vertebræ vary; as does the number of the ribs, together with their relative breadth and the presence of processes. The size and shape of the apertures in the sternum are highly variable; so is the degree of divergence and relative size of the two arms of the furcula. The proportional width of the gape of mouth, the proportional length of the eye-lids, of the orifice of the nostrils, of the tongue (not always in strict correlation with the length of beak), the size of the crop and of the upper part of the œsophagus: the development and abortion of the oil-gland; the number of the primary wing and caudal feathers; the relative length of wing and tail to each other and to the body; the relative length of leg and of the feet; the number of scutellæ on the toes, the development of skin between the toes, are all points of structure which are variable. The period at which the perfect plumage is acquired varies, as does the state of the down with which the nestling birds are

clothed when hatched. The shape and size of the eggs vary. The manner of flight differs remarkably; as does in some breeds the voice and disposition. Lastly, in certain breeds, the males and females have come to differ to a slight degree from each other."

"Altogether at least a score of pigeons might be chosen, which if shown to an ornithologist, and he were told that they were wild birds, would certainly, I think, be ranked by him as well-defined species. Moreover, I do not believe that any ornithologist would place the English carrier, the short-faced tumbler, the runt, the barb, pouter, and fantail in the same genus; more especially as in each of these breeds several truly-inherited sub-breeds, or species as he might have called them, could be shown him."

"Great as the differences are between the breeds of pigeons, I am fully convinced that the common opinion of naturalists is correct, namely, that all have descended from the rock-pigeon (*Columba livia*), including under this term several geographical races or sub-species, which differ from each other in the most trifling respects. As several of the reasons which have led me to this belief are in some degree applicable in other cases, I will here briefly give them. If the several breeds are not varieties, and have not proceeded from the rock-pigeon, they must have descended from at least seven or eight aboriginal stocks; for it is impossible to make the present domestic breeds by the crossing of any lesser number: how, for instance, could a pouter be produced by crossing two breeds unless one of the parent-stock possessed the characteristic enormous crop? The supposed aboriginal stocks must all have been rock-pigeons, that is, not breeding or willingly perching on trees. But besides *C. livia*, with its geographical sub-species, only two or three other species of rock-pigeons are known; and these have not any of the characters of the domestic breeds. Hence the supposed aboriginal stocks must either still exist in the countries where they were originally domesticated, and yet be unknown to ornithologists; and this, considering their size, habits, and remarkable characters, seems very improbable; or they must have become extinct in the wild state. But birds breeding on precipices, and good fliers, are unlikely to be exterminated; and the common rock-pigeon, which has the same habits with the domestic breeds, has not been exterminated even on several of the smaller British islets, or on the shores of the Mediterranean. Hence the supposed extermination of so many species having similar habits with the rock-pigeon seems to

me a very rash assumption. Moreover, the several above-named domesticated breeds have been transported to all parts of the world, and, therefore, some of them must have been carried back again into their native country; but not one has ever become wild or feral, though the dovecot-pigeon, which is the rock-pigeon in a very slightly altered state, has become feral in several places. Again, all recent experience shows that it is most difficult to get any wild animal to breed freely under domestication; yet on the hypothesis of the multiple origin of our pigeons, it must be assumed that at least seven or eight species were so thoroughly domesticated in ancient times by half-civilized man, as to be quite prolific under confinement."

"An argument, as it seems to me, of great weight, and applicable in several other cases, is, that the above-specified breeds, though agreeing generally in constitution, habits, voice, colouring, and in most parts of their structure, with the wild rock-pigeon, yet are certainly highly abnormal in other parts of their structure: we may look in vain throughout the whole great family of Columbidæ for a beak like that of the English carrier, or that of the short-faced tumbler, or barb; for reversed feathers like those of the jacobin; for a crop like that of the pouter; for tail-feathers like those of the fan-tail. Hence it must be assumed not only that half-civilized man succeeded in thoroughly domesticating several species, but that he intentionally or by chance picked out extraordinarily abnormal species; and further, that these very species have since all become extinct or unknown. So many strange contingencies seem to me improbable in the highest degree."

"Some facts in regard to the colouring of pigeons well deserve consideration. The rock-pigeon is of a slaty-blue, and has a white rump (the Indian sub-species, *C. intermedia* of Strickland, having it bluish); the tail has a terminal dark bar, with the bases of the outer feathers externally edged with white; the wings have two black bars; some semi-domestic breeds and some apparently truly wild breeds have, besides the two black bars, the wings chequered with black. These several marks do not occur together in any other species of the whole family."

"Now, in every one of the domestic breeds, taking thoroughly well-bred birds, all the above marks, even to the white edging of the outer tail-feathers, sometimes concur perfectly developed. Moreover, when two birds belonging to two distinct breeds are

crossed, neither of which is blue or has any of the above-specified marks, the mongrel offspring are very apt suddenly to acquire these characters; for instance, I crossed some uniformly white fantails with some uniformly black barbs, and they produced mottled brown and black birds; these I again crossed together, and one grandchild of the pure white fantail and pure black barb was of as beautiful a blue colour, with the white rump, double black wing-bar, and barred with white-edged tail-feathers, as any wild rock-pigeon. We can understand these facts, on the well-known principle of reversion to ancestral characters, if all the domestic breeds have descended from the rock-pigeon. But if we deny this, we must make one of the two following highly improbable suppositions. Either, firstly, that all the several imagined aboriginal stocks were coloured, and marked like the rock-pigeon, although no other existing species is thus coloured and marked, so that in each separate breed there might be a tendency to revert to the very same colours and markings. Or, secondly, that each breed, even the purest, has within a dozen or, at most, within a score of generations, been crossed by the rock pigeon: I say within a dozen or twenty generations, for we know of no fact countenancing the belief that the child ever reverts to some one ancestor, removed by a greater number of generations. In a breed which has been crossed only once with some distinct breed, the tendency to reversion to any character derived from such cross will naturally become less and less, as in each succeeding generation there will be less of the foreign blood; but when there has been no cross within a distinct breed, and there is a tendency in both parents to revert to a character, which has been lost during some former generation, this tendency, for all that we can see to the contrary, may be transmitted undiminished for an indefinite number of generations. These two distinct cases are often confounded in treatises on inheritance."

"Lastly, the hybrids or mongrels from between all the domestic breeds of pigeons are perfectly fertile. I can state this from my own observations, purposely made on the most distinct breeds. Now, it is difficult, perhaps impossible, to bring forward one case of the hybrid offspring of two animals *clearly distinct* being themselves perfectly fertile. Some authors believe that long-continued domestication eliminates this strong tendency to sterility: from the history of the dog I think there is some probability in this hypothesis if applied to species closely related together,

though it is unsupported by a single experiment. But to extend the hypothesis so far as to suppose that species, aboriginally as distinct as carriers, tumblers, pouters, and fantails now are, should yield offspring perfectly fertile, *inter se*, seems to me rash in the extreme."

"From these several reasons, namely, the improbability of man having formerly got seven or eight supposed species of pigeons to breed freely under domestication; these supposed species being quite unknown in a wild state, and their becoming nowhere feral; these species having very abnormal characters in certain respects as compared with all other Columbidæ, though so like in most other respects to the rock-pigeon; the blue colour and various marks occasionally appearing in all the breeds, both when kept pure and when crossed; the mongrel offspring being perfectly fertile;—from these several reasons, taken together, I can feel no doubt that all our domestic breeds have descended from the *Columba livia* with its geographical sub-species."

"In favour of this view, I may add, firstly, that *C. livia*, or the rock-pigeon, has been found capable of domestication in Europe and in India; and that it agrees in habits and in a great number of points of structure with all the domestic breeds. Secondly, although an English carrier or short-faced tumbler differs immensely in certain characters from the rock-pigeon, yet by comparing the several sub-breeds of these breeds, more especially those brought from distant countries, we can make an almost perfect series between the extremes of structure. Thirdly, those characters which are mainly distinctive of each breed, for instance the wattle and length of beak of the carrier, the shortness of that of the tumbler, and the number of tail-feathers in the fantail, are in each breed eminently variable; and the explanation of this fact will be obvious when we come to treat of selection. Fourthly, pigeons have been watched, and tended with the utmost care, and loved by many people. They have been domesticated for thousands of years in several quarters of the world; the earliest known record of pigeons is in the fifth Ægyptian dynasty about 3000 B. C., as was pointed out to me by Professor Lepsius; but Mr. Birch informs me that pigeons are given in a bill of fare in the previous dynasty. In the time of the Romans, as we hear from Pliny, immense prices were given for pigeons; "nay, they are come to this pass, that they can reckon up their pedigree and race." Pigeons were much valued by Akber Khan in India,

about the year 1600; never less than 20,000 pigeons were taken with the court. "The monarchs of Iran and Turan sent him some very rare birds;" and, continues the courtly historian, "His Majesty, by crossing the breeds, which method was never practised before, has improved them astonishingly." About this same period the Dutch were as eager about pigeons as were the old Romans. The paramount importance of these considerations in explaining the immense amount of variation which pigeons have undergone, will be obvious when we treat of Selection. We shall then, also, see how it is that the breeds so often have a somewhat monstrous character. It is also a most favourable circumstance for the production of distinct breeds, that male and female pigeons can be easily mated for life; and thus different breeds can be kept together in the same aviary."

The common rock-pigeon is thus proved to be highly variable in a state of domestication, so much so that naturalists not aware of all the facts, might well be excused for concluding, as some of them have done in the similar instances of the ox, the domestic fowl, and man himself, that the varieties represent several distinct species. To what then do these differences amount? (1) They are mainly in non-essential points, as colour, development of feather, etc., and they do not consequently interfere, to any important extent, with the food and habits of the animal; or if we were to represent the matter from the opposite point of view to that taken by Mr. Darwin, the constitution and instincts of the species being fixed by the law of its creation, it cannot vary beyond these. The author is clearly wrong in stating that any of them could amount to generic distinctions; that is, if genera are to be based on *structural* differences, for of these there is comparatively little, except in the one point of proportion of parts, difference in which is of specific value only, and often occurs in near varieties. (2) Many of the differences are abnormal; that is, they are of the character of monstrosities, and this separates them widely from true specific differences. (3) The varieties are perfectly fertile, which is not the case with hybrids between clearly distinct species. (4) The cross breeds revert to the characters of the rock-pigeon, showing that the specific type still remains uneradicated, or that each variety is, so to speak, a hemitropic form, which, when united with an opposite one, tends to reproduce the original form. It follows from these results, that, however

likely to be mistaken for species, the varieties of the pigeon are really something essentially different from true species, and the same conclusion would hold with any animal that could be selected.

We now come to the causes of variation in a state of domestication; and here, already, in the twenty-ninth page of his volume, we find our author leaving the basis of fact and losing himself in the mazes in which he henceforth continues to wander. He attributes the varieties of domestic animals to "Man's power of accumulative selection; nature gives successive variations; man adds them up in certain directions useful to him." We object to this, as altogether a partial and imperfect statement. It is not nature that gives the variations, but external circumstances; while nature only gives a certain capacity to vary, the extent of which is the point in question. Man places animals in abnormal conditions into which their instincts and natural powers would not permit them of themselves to enter. They vary in consequence of these, sometimes suddenly, sometimes gradually, sometimes from premeditated treatment, sometimes unaccountably, sometimes in directions useful to man, sometimes the reverse. Out of all the diversities thus produced, man no doubt selects what suits him, and keeps it, as far as he can, in the conditions favorable to its permanence and improvement; but such selection is a comparatively small part of the actual cause of the phenomena observed, which result really from unnatural conditions of life compelled by man. Who selected, for example, the niata cattle of South America, the hairless dogs of Chili, the tail-less cats of the Isle of Man, and many other forms?

Selection is no doubt an important cause of the continuation and improvement of varieties, and has also, as our author maintains, been practised from a very remote antiquity in the case of the more valuable domesticated animals. He might have referred to a more ancient case than any of those he has noticed. Laban selected all the speckled cattle from Jacob's flock, understanding very well the principle of selection; but Jacob was better informed than Laban or Mr. Darwin, and not trusting to selection, but knowing the effect of external influences and their special importance in the embryonic state, he set up peeled twigs before the pregnant cattle, and so acting on the embryo through the senses of the mother, produced the variety he desired. The undue prominence given to selection by our author is the main basis on which he subsequently proceeds.

His next step is to establish analogies between variation and specific difference, as observed in nature. Many species are doubtful; that is, naturalists are not quite decided that they may not be varieties. This is true; but such species are the exceptions, and the differences of view have arisen as much from defective observation or reasoning as from any real difficulty. Again, in large genera the species approach each other very nearly. This is inevitable from the nature of the case, and though it may cause difficulties in distinguishing them, it proves nothing as to their not being true species. Species which range widely also are prone to vary, and this also follows from the nature of the case, great range and much variability being really cause and effect, and reacting on each other. Farther, it is stated that species belonging to large genera are more prone to vary than species belonging to small genera. This has not been established as a general principle, nor, if it should be, would it necessarily bear the interpretation put upon it. To reach the facts we must be certain that we are comparing natural genera consisting of species having true affinities of structure, and that all our generic distinctions are based on the same grades of difference. Further, we must make separate lists of the genera small now but large if we take all geological time, as for instance the genus *Lingula*, of genera small in any particular country, but large if the whole world be taken; and lastly, of genera large in some particular region or country. This last is the only case which can fairly test Mr. Darwin's principle, and we must say that in our limited experience there appear to be quite as many exceptions as agreements with the rule. Take, for instance, the genera *Solidago* and *Aster* among American plants, which, though growing together in numerous species, are not remarkably variable. Further, when a generic type has proved suitable to occupy many places in a particular country, it may well be that many of its species will be capable of a wide range, and so variable. For such reasons we hold that the attempt made on the ground of analogies between the species and the variety to break down the distinction between them signally fails.

But if the reader is willing to take this for granted, Mr. Darwin will carry him a step further. He next proceeds to maintain that in nature there is a power of selection similar to that which the breeder exercises—a power of "Natural Selection" not heretofore recognised, and by virtue of which varieties are produced and developed

into species. There is here a huge hiatus in the reasoning of our author. We have already shown that an excessive importance is attributed to artificial or human selection; but with all the exaggeration of its powers, it has proved insufficient to change one species into another. The pigeon, with all its varieties, is still a pigeon, and, according to our author's own conclusive argumentation, a rock-pigeon. It is not a wood-pigeon, or turtle dove, still less a partridge or a rook. But now we are asked to believe that those same natural courses which break down all the breeder's elaborate distinctions so soon as his breeds are allowed to intermix and live in a natural way, are themselves able to take up the work and do still greater marvels in the way of selection. Such a doctrine is self-contradictory, and, we believe wholly incapable of proof; but let us see how this is attempted:

As might have been anticipated, natural selection being either creation or nothing, a new power is evoked as a *primum mobile.* This is the "struggle for existence," a fancied warfare in nature, in which the race is always to the swift and the battle to the strong, and in which the struggle makes the strong stronger. In a previous chapter we have been told very truly that the reason why the wealthy and skilful breeder succeeds in producing marked races is that his animals are cared for and pampered, while the savage and the poor man fail because their animals must struggle for subsistence. Nature it appears takes the opposite way, and improves her breeds by putting them through a course of toil and starvation, a struggle not for happiness or subsistence, but for bare existence. We can understand how this should deteriorate and degrade species, as we know it has done in every case of the kind that we have observed; but how it should elevate or improve is past comprehension. But does nature deserve to be charged with such niggardliness, and with so concealing it that all the world seems to be full of happiness and plenty, except where poor man toils on in his poverty? In looking for the proof of this strange doctrine, we find stated in support of it only a number of isolated and exceptional facts, many of them cases in which man interferes with the equilibrium of nature; and we have to fall back on the general statement that the struggle for existence inevitably fol lows from the high rate at which organic beings tend to increase but this Malthusian doctrine, though good for a single species viewed by itself, is false for the whole in the aggregate. Vegetable life and the lower forms of animal life support the higher,

and these supporting forms increase far more rapidly than those that subsist on them. So much so, that vast quantities of organic food go to waste, or would do so but for the hordes of scavengers of low organization that seem specially created to gather up the fragments of nature's bounteous feast. Plant life thrives on the exhaustless stores of inorganic food provided for it by the soil and the atmosphere. Plant life supports animal life; but who ever saw the floor of the ocean denuded of its algæ, or the landscape bared of its verdure by the struggle of feeders for existence, except in a rare and exceptional case, as in a flight of locusts? There is always enough and to spare. Again, do the insects fail or become scarce under the ceaseless attacks of the insectivorous birds? Do not *Clios* and *Salpas* and coral polyps abound almost as much as if not preyed on by countless fishes and other animals? The beautiful harmony of nature provides that the feeders shall multiply more slowly than the food, and that the food shall be kept under by the feeders. When any form does locally multiply too far, the checks appear, usually in the form of a diminished reproduction or in the more rapid removal of the infirm, the sickly and the aged. When through the slow operation of physical causes or the introduction of new species, certain forms of life can no longer find the means of subsistence, all the facts we know indicate their disappearance, not their change into new forms. Nay, species verging to extinction or struggling for existence, like the red deer of Scotland, degenerate rather than improve, and must necessarily do so, so long as the laws of organic being remain what they are. In short, the struggle for existence is a myth, and its employment as a means of improvement still more mythical.

Were we bound to argue for such a thesis as that proposed by Mr. Darwin, we should much rather take up our ground on the improvement of the physical conditions of the earth, and maintain that each species finding its means of subsistence and happiness constantly extending, exerted itself for their occupancy, and so developed new powers. This would have the advantage of giving a more agreeable view of nature, and of accounting for elevation; as if nature, like a skilful breeder, were giving constantly better food or pasture, instead of imitating the luckless experimenter who strove to reduce the daily food of the horse to a single straw.

The remarks that we have made on natural selection, and the struggle for existence, afford a key to the whole of Mr. Darwin's argument, which amounts to little else than a wholesale appropria

tion of all the effects of external conditions of existence to these supposed causes of change. We could fill pages with evidence of the entire confusion of ideas which pervades his mind on this point, but one extract must suffice, both as an indication of this confusion, and as a fair example of the argument:

"How much direct effect difference of climate, food, &c., produces on any being is extremely doubtful. My impression is that the effect is extremely small in the case of animals, but perhaps rather more in that of plants. We may, at least, safely conclude that such influences cannot have produced the many striking and complex co-adaptations of structure between one organic being and another, which we see everywhere throughout nature. Some little influence may be attributed to climate, food, &c.: thus, E. Forbes speaks confidently that shells at their southern limit, and when living in shallow water, are more brightly coloured than those of the same species further north or from greater depths. Gould believes that birds of the same species are more brightly coloured under a clear atmosphere, than when living on islands or near the coast. So with insects, Wollaston is convinced that residence near the sea affects their colours. Moquin-Tandon gives a list of plants which when growing near the sea-shore have their leaves in some degree fleshy, though not elsewhere fleshy. Several other such cases could be given."

"The fact of varieties of one species, when they range into the zone of habitation of other species, often acquiring in a very slight degree some of the characters of such species, accords with our view that species of all kinds are only well-marked and permanent varieties. Thus the species of shells which are confined to tropical and shallow seas are generally brighter coloured than those confined to cold and deeper seas. The birds which are confined to continents are according to Mr. Gould, brighter coloured than those of islands. The insect species confined to sea-coasts, as every collector knows, are often brassy or lurid. Plants which live exclusively on the sea-side are very apt to have fleshy leaves. He who believes in the creation of each species, will have to say that this shell, for instance, was created with bright colours for a warm sea; but that this other shell became bright coloured by variation when it ranged into warmer or shallower waters."

"When a variation is of the slightest use to a being, we cannot tell how much of it to attribute to the accumulative action of natural selection, and how much to the conditions of life. Thus,

it is well known to furriers that animals of the same species have thicker and better fur the more severe the climate is under which they have lived; but who can tell how much of this difference may be due to the warmest-clad individuals having been favoured and preserved during many generations, and how much to the direct action of the severe climate? for it would appear that climate has some direct action on the hair of our domestic quadrupeds."

"Instances could be given of the same variety being produced under conditions of life as different as can well be conceived; and, on the other hand, of different varieties being produced from the same species under the same conditions. Such facts show how indirectly the conditions of life must act. Again, innumerable instances are known to every naturalist of species keeping true, or not varying at all, although living under the most opposite climates. Such considerations as these incline me to lay very little weight on the direct action of the conditions of life. Indirectly, as already remarked, they seem to play an important part in affecting the reproductive system, and in thus inducing variability; and natural selection will then accumulate all profitable variations, however slight, until they become plainly developed and appreciable by us."

It would be possible to fill up the remainder of our space with the objections we have to the statements in these few paragraphs. The scepticism as to the effects of food, climate, &c., in producing variation, and the effects attributable to a supposed selecting power which can merely act on such changes when previously induced; the failure to perceive that the adaptation of certain species to certain conditions of life necessarily implies that if other species not so adapted migrate within the influence of the conditions, they must, so far as their natures permit, be influenced by them; that in short such variation vindicates the wisdom of the Creator while showing that the plasticity of species may simulate in a humble way specific distinctness; the feeble attempt to attribute the warm fur of northern varieties to selection, while manifestly unable to deny that climatic influence is the main cause; these are specimens of a style of thought which pervades the whole book, and which leaves the task of a reviewer hopeless, for it would require a book as large as the original to expose the fallacies which appear in every paragraph.

In one respect Mr. Darwin vindicates fully his well-earned

reputation as a scientific naturalist. He fairly and ably states the many objections to his view that must occur to the minds of zoologists, botanists and geologists, and manfully, though unsuccessfully, attempts to cope with them.

Such objections are, the geographical distribution of the creatures supposed in Mr. Darwin's view to be nearly related by descent, the want of the innumerable transitional forms that should exist, the difficulty of accounting for the peculiar instincts of many animals, the sterility of first crosses and hybrids compared with the fertility of crosses of varieties, the want of any trace of unlimited variation in the geological succession of animals.

We shall only refer to the last of these, the geological objection. Geology he admits shews no trace of the "finely graduated organic chain" which in his theory should connect man with the extinct kangaroo-rat-like marsupials of the oolite and trias, and all our existing animals and plants with the perished creatures supposed to be their progenitors. He has but one explanation of this, the "extreme imperfection of the geological records." To illustrate this imperfection, he refers to the immense lapse of time involved in the geological record, to the small number of species known compared with this great lapse of time, to the breaks caused by the absence of fossiliferous deposits at certain periods. All these are fair abatements from the completeness of the geological series, and many of the remarks made on them are very valuable; but they do not mitigate the condemnation of the selection theory pronounced by geology. Breaks in the geological record are usually only local, and if general, might indicate actual destruction and renewal of species. Though it is true that estuary and land deposits have in most cases been preserved only in times of subsidence; this is not true of marine deposits, some of the most perfect of which mark times of elevation. Moreover, in those parts of the geological scale which are the most perfect and unbroken, there is no graduated transition of forms. Take for instance the great Silurian limestones of America, or the plant-bearing beds of the coal formation. In both we find some species perseveringly unchanged through many great deposits, and others suddenly appearing and disappearing, and this in cases where the profusion of specimens and continuity of formations preclude any supposition of much imperfection in the evidence. Nothing is more conclusive on this subject than the last of the fossiliferous deposits, next to the modern period; as, for instance, the Post-Pliocene clays and

sands of Canada. These belong to a period of elevation proceeding gradually from the time of the boulder formation up to the modern era. In these deposits we have more than stxty species of invertebrate animals, all except one or two known to be now living in the Gulf of St. Lawrence. Yet in all this lapse of time not one of the species has, by natural selection or any other cause, varied more than its living relatives now do. Still further, one or two species, as the *Leda truncata* and *Trichotropis arctica*, now found only in the Arctic seas, are quite like their modern representatives in those distant waters. They had plenty of time to vary, in order to suit the new circumstances, but they could not. Further, at the same time when these shells lived in the plains of Canada, Arctic plants, conveyed probably by ice, became settled on the White Mountains, the descendants of which still remain isolated but unchanged. Such facts as these are conclusive, notwithstanding the imperfection of the geological record on other points.

In one point our author endeavors to find support to his views from geological evidence, in the resemblance of successive faunas of the same locality to each other. The extinct tertiary animals of South America, New Zealand and Australia, for example, are like in type to those now inhabiting the same regions. But then we have no connecting links, and hence it seems more probable that successive creations were conformed to the same generic types, because the physical conditions remained unchanged, than that the modern sloths, for example, are degenerate descendants of the *Megatheria*. Farther, it does not seem to have occurred to Mr. Darwin that these resemblances are confined to the southern hemisphere. They do not obtain at all in North America, in Northern Asia, in Europe. In these countries new types have replaced the old, and certain old species, like the musk ox, the megaceros, the beaver, the aurochs, have become locally or wholly extinct, instead of undergoing change. All this has happened no doubt because the modern conditions are too dissimilar from the ancient to permit the continuance of old forms under any variety of them, and thus new forms have been introduced.

In his closing chapters the author endeavours to shew that his theory accounts in a satisfactory manner for the typical likeness of species to each other, for the curious embryological relations of animals, and for the existence of rudimentary organs; but all these things are equally intelligible on the opposite view. If spe-

cies are parts of a plan devised by an intelligent Creator, that plan must appear in their structures. If the plan embraces more general and more specialised contrivances, the latter must, in their earlier stages of growth, simulate the former. All organs, if there is a plan at all, must appear in its different parts in different degrees of relative perfection and complexity, and what we call rudimentary organs are merely the lowest of these degrees; not useless, for in many cases we know their uses, but of less relative importance than in other cases.

We have in the foregoing remarks dwelt chiefly on the points in which we believe the author to be mistaken; but we do not wish to undervalue the work. In many respects it is eminently useful. It shews, in opposition to many views maintained with much vigour on this side of the Atlantic, the great variability of species. It imposes a salutary caution on those naturalists who too readily admit geographical distribution as an evidence of specific distinctness. It illustrates by a vast fund of curious fact the obscure laws of variation and hybridity. All these pearls are not the less valuable to the judicious reader, that the author has seen fit to string them upon a thread of loose and faulty argument, and to employ them to deck the faded form of the transmutation theory of Lamarck.

In conclusion, it is but fair to state in his own words the ultimate deductions of the author, and then the opposite view, as maintained by the greater number of naturalists:—

"It may be asked how far I extend the doctrine of the modification of species. The question is difficult to answer, because the more distinct the forms are which we may consider, by so much the arguments fall away in force. But some arguments of the greatest weight extend very far. All the members of whole classes can be connected together by chains of affinities, and all can be classified on the same principle, in groups subordinate to groups. Fossil remains sometimes tend to fill up very wide intervals between existing orders. Organs in a rudimentary condition plainly show that an early progenitor had the organ in a fully developed state; and this in some instances necessarily implies an enormous amount of modification in the descendants. Throughout whole classes various structures are formed on the same pattern, and at an embryonic age the species closely resemble each other. Therefore I cannot doubt that the theory of descent with modification embraces all the members of the same class.

I believe that animals have descended from at most only four or five progenitors, and plants from an equal or lesser number.

"Analogy would lead me one step further, namely, to the belief that all animals and plants have descended from some one prototype. But analogy may be a deceitful guide. Nevertheless all living things have much in common, in their chemical composition, their germinal vesicles, their cellular structure, and their laws of growth and reproduction. We see this even in so trifling a circumstance as that the same poison often similarly affects plants and animals; or that the poison secreted by the gall-fly produces monstrous growths on the wild rose or oak-tree. Therefore I should infer from analogy that probably all the organic beings which have ever lived on this earth have descended from some one primordial form, into which life was first breathed."

We may well ask what is gained by such a result, even if established. The origin of species, as we now have them, it is true is mysterious, but what is gained by reducing them all to one primitive form? That would be an equal mystery, more especially if it included within itself the germs of all the varied developments of animal and plant life. By such a doctrine also we involve ourselves in a host of geological and other difficulties, and so break down the distinction between species and varieties as to deprive our classifications of any real value. On the contrary, if we are content to take species as direct products of a creative power, without troubling ourselves with supposed secondary causes, we may examine, free of any trammelling hypothesis, the law of their succession in time, the guards placed upon their intermixture, the limits set to their variation in each case, the remarkable arrangements for diminishing variations by the natural crossing of varieties, the laws of geographical distribution from centres of origin, and the physical causes of variation, of degeneracy, of extinction.

All these are questions to be investigated apart from any hypothesis of the common origin of different species on the one hand, or of the diverse origin of individuals apparently identical on the other; and we cannot doubt that the results will approach to the following conclusions. (1) That the origin of specific distinctness lies beyond the domain of any natural law known to us. (2) That the variations of the species are the effects of the combined influences of its natural endowments and of external circumstances. (3) That

in nature specific force and causes of variation constitute antagonist powers, acting and reacting on each other, and thus producing an equilibrium which is disturbed only by the artificial contrivance of man. We are quite certain that the belief of naturalists in these great doctrines will eventually be confirmed by Mr. Darwin's book, and that his failure, with all the immense mass of facts at his disposal, to maintain the theory of transmutation, will give an eternal quietus to the Lamarckian hypothesis; though we shall be quite prepared to find that for a time it may gain a wide acceptance with young naturalists, and with those who are willing to adopt any amount of error rather than appear not to be on a level with the latest scientific novelties. For this signal service to science we sincerely thank him, though we are sorry that it has been rendered by a man whose sincerity and honesty of purpose all who know him respect and love, and to whom natural science is under so many eminent obligations.

Since writing the above, we have seen able reviews of Mr. Darwin's work by Prof. Gray and Prof. Huxley. Both naturalists dissent from his ultimate conclusions as not satisfactorily proved, though neither, in our view, insists sufficiently on the fundamental unsoundness of the argument.

J. W. D.

ARTICLE X.—*Abridged Sketch of the life of Mr. David Douglas, Botanist, with a few details of his travels and discoveries.*

The inducement for collecting the few scattered fragments that are to be found in the following pages, is the desire to prolong somewhat, the public remembrance of one who was warmly attached to Natural History, and who also in his own short day, largely contributed by his enterprise and unwearied spirit of research, to swell the list of novelties in some of its principal departments. Cut down in the prime of life, and in the midst of his usefulness, his memory is still fondly cherished by his friends, and his successful exertions in his sphere of labour have procured him among botanists, an undying fame. Had he lived, he would have attained to the highest celebrity as a traveller, for his diligence in investigating, and accuracy in observing, would have tended to elucidate much that is of great interest in the physical geography of the earth.

David Douglas, of humble but respectable parentage, was born at Scoone in Perthshire in the last year of the last century. He received his early education at the parish school of Kinnoul, in the neighbourhood. He was somewhat wayward, and therefore frequently the mark for the master's ire. Trout-fishing and bird-nesting held out temptations too strong for the lively boy, and such occupations often lengthened his road, if they did not entirely prevent his march to school. His love of nature soon displayed itself in the rearing of birds, collecting of plants, and other such amusements. Following up these early intuitions, employment was found for him, first in the nursery ground and then in the gardens of the Earl of Mansfield, at Stowe.

Here his zeal and industry were so conspicuous, that they gained him the esteem and affection of the superintendent. After a seven years apprenticeship in these gardens, where he acquired a thorough knowledge of the practical part of gardening, the friendship of the superintendent Mr. Beatty, procured him a situation under Mr. Alexander Stewart, who had charge of the gardens at Valleyfield, the seat of Sir Robert Preston near Culross. There being at this place a very choice collection of plants, the attractions of the kitchen-garden and of out-door work, soon lost their weight with young Douglas, who now began to study botany, and to attach himself to the care of the exotics, of which Valleyfield could boast a magnificent display. Being very careful of the plants committed to his care, Mr. Stewart showed him much kindness, and allowed him the privilege and advantage of Sir Robert's botanical library. Such an opportunity was not lost by the youthful naturalist. The second year he became foreman to Mr. Stewart, when upon application, he gained admission to the Botanical gardens at Glasgow. This nursery of botanists was still in its infancy, but advancing rapidly to high reputation under the knowledge, skill, and fostering influence of Professor Hooker, since whose time, a succession of able and indefatigable Botanists have well preserved its celebrity. The energetic working qualities of Douglas, and his vivacity of disposition, speedily procured him the esteem and regard of all connected with the gardens; and the valuable friendship of the professor, which he at this time acquired, may be looked upon as the reward of his sterling merits. For the Professor, now Sir W. Jackson Hooker, I have heard him express such sentiments as a son might hold for a revered and beloved parent. First a diligent attendant at the botanical lectures,

next a favourite companion of the professor during his periodical excursions through the Highlands of Scotland, his capacity was quickly recognised by the keen judgment of Hooker, and the noble qualities of his mind pointed him out as one from whom much might be expected.

Douglas was afterwards recommended as botanical collector to the London Horticultural Society, for which he was indebted to Sir William, as well as to Mr. Stewart, Nursery Curator of the Glasgow Botanic Gardens, who always took a lively interest in his welfare. The recommendation was attended to, and the first appointment made out for the young botanist was to the United States. In the summer of 1823, he there procured many fine plants for the Society and added greatly to its collection of fruit trees. Pleased with his exertions, the Horticultural Society, thought of a wider field for their new collector, and the interior of North West America being a region yet unexplored by any naturalist, they wisely determined upon availing themselves of Douglas's youthful vigour and talents in that quarter. Joseph Sabine Esquire, then Honorary Secretary to the Society, took the most friendly notice of Douglas, and was also highly interested in the success of his mission, and the then Governor or Deputy-Governor of the Hudson's Bay Company, afforded every kind assistance, and such valuable information towards the prosecution of his labors, as to insure happy results.

The 25th of July 1824, found our scientific adventurer on board the Hudson Bay Company's ship William and Anne, fortunate in having the companionship of Dr. Scouler of Glasgow, a younger man than himself, but ardently devoted to everything pertaining to natural history. An extract from the sketch of his life taken from a London botanical periodical, will give some idea of the style in which Douglas recorded his observations on living nature. After crossing the tropics, he writes thus of the Albatross.

" While within the paralells of 50° and 60°, I caught sixty-nine " specimens of *Diomeda*, consisting of *D. exulaus, fulginosa*, and " *chlororynchos.* The last, though a smaller bird than the first, " reigns lord paramount over the rest, and compels them all to flee " at his approach. It is stated by most authors that these birds " are taken with the greatest ease during warm weather ; it was " only during the driving gusts of a storm that I could secure them, " and on such occasions they fight voraciously about the bait, the " hook often being received into the stomach. The appearance of

" these birds is grand and majestic ; the largest which I ever saw, " measured twelve feet four inches from tip to tip of the extended " wings, and four feet from the point of the beak to the end of the " tail. As respects their flight, the same renarks apply to all the " species. When sitting on the water their wings are raised ex- " actly like a swan's ; when feeding they are somewhat higher, with " a constant tremulous motion like those of the hawk tribe ; and " when elevating themselves in the water to soar in the air, they " first walk the water, skimming the surface with the points of " their pinions for the distance of several hundred yards, before " they seem able to raise themselves, which they generally do with " the utmost grace, and with scarcely any apparent movement of " their wings. They are of a bold and savage disposition, which " is especially displayed when they are captured."

At the island of Juan Fernandez he fell in with a poor sailor, named William Clarke, who had employment from the Spaniards who visit this place for the purpose of killing seals and wild cattle, which were plentiful. Near the remains of an old church once built there, Douglas writes " there is a circular oven, built of London " fire-brick, seven feet in diameter within, bearing the date 1741, " and therefore probably built by Anson during his residence."

" Some pigeons of a small blue species, now occupy it as their " cote. There were eggs in it but no young ones. I pointed it out " to Clarke, and advised him to make use of this colony."

In the old gardens were found peaches of three or four sorts, quinces, apples, and pears ; figs and vines were also in a thriving state. Before leaving, Douglas left with Clarke, the seeds of some culinary vegetables, radishes being the only article of that kind that appeared to be on the island. Douglas's eye was alive to all that is picturesque, and his glowing description of that enchanting spot, is thus given with the spirit of a botanist.

" No pen, indeed, can correctly describe the charming and rural " appearance of this island ; the numerous rills descending through " valleys overshadowed by luxuriant verdure, and terminating in " dark recesses and rocky dells, where wave the fronds of *Lomatia*, " *Aspidia* and *Polypodia*, several species of which are new and of " princely form and growth. On the hills grow several kinds of " *Escallonia*, *Berberis*, *Lobelia*, *Hordeum*, and *Avena*. During " my short stay, I gathered seventy distinct and highly interesting " plants. The species of birds were few and not beautiful."

Arrived at the Gallipagos, Mr. Douglas was on shore on one of

that group, named James island, from which he drew a fair collection of both birds and plants, nearly all of which were lost to him in consequence of the dampness of the vessel below, and the incessant rains upon deck. Of one hundred and seventy-five species of plants gathered, he saved but fifty, and of birds, one only remained to him of the forty-five he had killed. This was but an earnest of the still heavier losses he afterwards sustained in his collections. He says of the Gallipagos :—"Their verdure is scanty as com-"pared with most tropical countries, owing apparently to the "parched nature of the soil, and the absence of springs of fresh "water. The only spring I saw, was flowing from a crevice of one "of the craters. Some of the trees attain a considerable size in the "valleys, but they are not numerous, and with little variety of "species. The birds, however, are abundant, and some of them "exceedingly handsome, but so ignorant were they of man's de-"vices, that they suffered themselves to be killed with a stick, so "that a gun was only needed when they sat high on the top of a "tree or rock. Many of the small birds perched on my hat, and "even unconsciously settled upon the gun (the instrument of "their destruction,) which I carried on my shoulder."

One may form an idea of the difficulty of entering the Columbia river in the winter season, from the fact that the William and Anne was obliged to lay to in a tremendously heavy sea, from the 12th of February until the 7th of April ere she dared to attempt crossing the bar. On the latter date, Douglas had the happiness of passing Cape Disappointment and of viewing from the vessel's deck the luxuriant growth of vegetation on the banks of the Columbia, which he regarded with anxiety as the scene of his future labors, but also with the highest satisfaction, for there was laid before him all that mortal could desire of beauty of landscape, and all that science might covet from any single portion of the habitable globe.

Mr. Douglas's first excursions were made in the neighbourhood of Fort Vancouver, and he was there at once introduced to the modes of travelling that have to be adopted in a wild Indian country. Of a robust constitution and merry heart, he would with the greatest complacency wrap his blanket round him and stretch himself out on the beach or under a bush as if he were lying down in a comfortable bed. In a few months he had collected a number of plants, many of them rare and new, and had besides dried the seeds he had gathered for sending to England.

In the month of October, he had the pleasure of making his first shipment of plants and seeds for England by the same vessel in which he had sailed from London, and the Horticultural Society made the most of this collection.

By the skill and care applied to the raising of the seeds, the gardens of England both public and private were quickly supplied with a share of the newly introduced plants, and the finest flowers of North-west America soon became generally distributed.

Of the mode of life which had frequently to be adopted by our indefatigable collector, extracts from his own narrative will give the best explanation.

" Early in the morning of the 19th July, I descended the river " in an Indian canoe for the purpose of prosecuting my researches " on the coast, a design which was in a great measure frustrated " by the tribe among whom I lived going to war with the nations " residing to the northward, in that very direction which I in- " tended to follow. During my stay several persons were killed, and " some wounded in a quarrel. The principal chief in the village, " Cockqua, treated me with the utmost fidelity, and even built me " a small cabin in his own lodge, but the immense number of fleas " occasioned me to remove to within a few yards of the river : still " my friend was so much interested in my safety that he watched " himself a whole night, at the time that he expected the war party, " In the morning about three hundred men, in their war garments. " danced the war dance, and sang several death-songs, which " caused in me certainly, a most uncomfortable sensation, and the " following morning brought us seventeen canoes carrying nearly " four hundred men, when after several harangues, it was mutually " agreed to suspend hostilities for the present."

" A sturgeon was caught by one of my companions, which " measured twelve feet nine inches, from the snout to the tip of " the tail, and seven feet round the thickest part, and its weight " exceeded five hundred pounds. Among the plants which I found " on this occasion, were, *Lupinus littoralis*, *Carex Menziesii*, " *Juncus Menziesii* and *globosus*, *Vaccinium ovatum*, *parvifolium* " and *ovalifolium*. I also obtained seeds of the beautiful *Spiræa* " *ariafolia*, of *Gualtheria*, *Shallon*, *Ribes sanguineus*, *Berberis*, " and other valuable and interesting plants."

" Before taking leave of my Indian friends, I purchased several " articles of wearing apparel, and things used in their domestic eco- " nomy for which I paid in trinkets and tobacco. I arrived at Fort

" Vancouver again on the 5th of August, and employed myself until " the 18th in drying the specimens I had collected, and making " short journeys in quest of seeds and other plants, my labours being " materially retarded by the rainy weather. As there were no " houses yet built on this new station, I first occupied a tent " which was kindly offered me, and then removed to a lodge " of deerskin, which soon, however, became too small for me, in " consequence of the augmentation of my collections, and where " also I found some difficulty in drying my plants and seeds. A " hut constructed of the bark of the *Thuja occidentalis* was my " next habitation, and there I shall probably take up my winter " quarters. I have only been in a house three nights since my " arrival in North-west America, and these were the first after my " debarkation. On my journeys I occupy a tent, wherever it is " practicable to carry one ; which, however, is not often, so that " a canoe turned upside down, is my occasional shelter ; but more " frequently I lie under the boughs of a pine tree, without any- " thing further."

About the end of August, while on an excursion up the Multuomak or Willamette river, he became aware of the existence of an enormous kind of pine, by finding very large pine seeds in the tobacco pouches of the Calapooeah Indians. When informed by these people that the tree was very large, and that its seeds were eaten as an article of food, he at once set about verifying this information, and gave the species the name of *Lambertiana*, so that this mighty tenant of the forest, second in size only to the gigantic *Sequoia*, (the *Wellingtonia* of Lindley,) now received its baptism or specific name, although, it was sometime afterwards, before Douglas saw it in all its magnificent proportions. In the month of September he visited the Cascades, heavy rapids of the Columbia, the first from the sea, and where the river breaks through the rocky barrier of the great volcanic range of Mounts Rainier and St. Helen's to the north, and their partners Hood and Jefferson to the south. After an unsuccessful attempt to scale the wooded summits on the north side, he returned, being short of food, and had two days repose ; when he occupied his time with shooting seals as they descended the surging rapids, in quest of salmon. Starting then for an exploration of the other side, his wishes were gratified, and he gained the upper wooded regions, where he was rewarded with many new plants, and discovered the *Pinus nobilis* and *P. amabilis*, the former a

spruce of much grandeur and straightness in growth, the latter the most elegant, perhaps, of all the Silver Firs. His exertions being thus crowned with success, the fatigued botanist turned his steps downwards towards Fort Vancouver, in order to look after his packages for England, of which we have already spoken.

In the end of October, although much impeded in his movements, by a hurt which he had received in his knee, he was again afloat in a small canoe proceeding towards the mouth of the Columbia. Leaving Cape Disappointment, he took the coast to the northward, sometimes making portages, and at others keeping with his Indian guide, in the tiny craft on rivulets skirting the shore. At Cape Foulweather, the canoe was abandoned and a march of sixteen miles made to gain Whitby Harbour, where the Chiheelis empties itself into the Pacific. Here we shall take up his own words.

" On arriving there, when we found the village deserted, I can " hardly describe the state I was in. While my guide and the " Indians were collecting some drift-wood, I made a small booth of " pine branches, straw, and old mats My blanket having been " drenched all day, and the heavy rain affording no opportunity of " drying it, I deemed it imprudent to lie down to sleep, and ac- " cordingly spent the night sitting over the fire. The following day " found me so broken down with fatigue and starvation, and my " knee so much worse, that I could not stir out. We fared most " scantily on the roots of *Sagittaria sagittifolia* and *Lupinus* " *littoralis*, called in the Chenook language, Somuchtau, till crawl- " ing out a few steps with my gun, I providentially saw some " wild birds, and killed five ducks at one shot. These were " soon cooked, though one of the Indians ate his share raw. To " save time in plucking the fowl, I singed off the feathers, and " with a basin of tea made a good supper on one of them. I had " certainly been very hungry, yet strange to say, as soon as I saw " the birds fall, my appetite fled, and I could hardly persuade " myself that I had been in such want."

Having procured assistance at a village on the opposite side of the bay, he turned up the Chiheelis river, but after being three days on this stream, he found the weather still continuing so rainy, that he discharged his guide, and hired another Indian with a horse to carry his luggage across to the Cowlidsk river. This distance, though only forty miles, occupied two days, all the low grounds being flooded with water; and the roads in the woods

marshy with incessant rain. At the Cowlidsk, he lighted upon a small boat, belonging to the Hudsons' Bay Company, which had been lent to an Indian chief. In this, by using his cloak and blanket for sail, he got back to Fort Vancouver at midnight on the 15th of November, completely worn out, and in nearly a famished state. The weather had done its worst, and his knee was in a still more painful condition from the fatigue and cold to which he had been exposed. He was now, therefore, compelled to lay himself up in winter quarters to recruit. The months of December, January and February, were passed by him with his Vancouver friends, his time usefully occupied in collecting subjects of zoological interest, and working out in full the short notes he had taken on his various journeys.

In March of 1826 the enterprising subject of our sketch being bent on a still more extensive tour than he had hitherto made, left his wintering station with the boats that were proceeding for the upper Columbia. At the Chûtes, or first great falls of the river, six miles above the Dalles, the party, as was frequently the case there, had difficulties with the Indians in passing the portage. Douglas in his own lively manner describes the scene.

" After taking a hurried and anxious breakfast on the rocks, " we proceeded several miles up the river, and in the afternoon " made the portage over the Great Falls, where Mr. McLeod was " apprized that the Indians were lying in wait with the intention " of attacking us, and pillaging the boats. This warning proved " too correct, no sooner had they received the customary present of " of tobacco, than they became desirous of compelling us to en- " camp for the night, that they might the better effect their pur- " pose. The first symptom of hostile intentions which we ob- " served, was their cunning trick of sprinkling water on the gun- " barrels of our party, and when the boats were ordered to be put " into the water, they would not allow it to be done. As Mr " McLeod was laying his hand on the shoulders of one native to " push him back, another fellow immediately drew from his " quiver a bow and a handful of arrows, and presented it at Mr. " McLeod. My position at the time, at the outside of the crowd " enabling me to perceive this manœuvre, and no time being to be " lost, I instantly slipped the cover of my gun, which was " fortunately loaded with buck-shot, and presenting it at him, I " invited him to discharge his arrow, when I would return it " with my own weapon. Just at this moment a chief of the Ky-

" ouse tribe, and three of his young men, who are the terror of " all the other tribes west of the mountains, and the staunch " friends of the whites, (as they call us), stepped in among the " party, and settled the affiair without any further trouble. This " very friendly Indian, who is one of the finest figures of a man " I have ever seen, six feet six inches high, then accompanied " us several miles up the river to the spot where we intended " to encamp for the night, and was liberally renumerated by " Mr. McLeod for his courageous and timely interference, and " friendship. I being King George's chief, or the " Grassman," " bored a hole through the only shilling which I possessed, and " which had been in my pocket ever since I left London, and " observing that the septum of his nose was perforated, I suspended " the coin to it by a bit of brass wire, a ceremony which after- " wards proved a seal of lasting friendship between us."

When he had reached Fort Colville, a short distance from the Kettle Falls, he was busily occupied for three weeks, when the lock of his gun having been broken, he determined on wending his way to the old, and then abandoned establishment at Spokan. Here resided old Jacquo Finlay, a remnant of the first Rocky Mountain Trappers, and once interpreter for the North-West Company among the Flat-head Indians. Jacquo was also the only craftsman who could work in good steel, within a distance of 800 miles. Starting with two youths to guide him, the traveller comes to the Barrier river, which has to be forded in passing from Colville to Spokan, and here we again take up his own description of the journey.

" No natives being near to help us across in their canoes, my " two young companions and I had the alternative of making a " raft or swimming, and being all well accustomed to the water, " we chose the latter. Unsaddling the horses, we drove them in, " and they all crossed with safety and ease, except one poor animal " which getting entangled by its hind legs among some brushwood " at the bottom, struggled a long time till the impediment giving " way he finally relieved our anxiety by gaining the other side. " I myself made two trips across, carrying my paper and gun the " first time and my blanket and clothes the second ;—the latter " articles I was obliged to hold above water in both my hands, " a difficult and tedious process, during which, as if to render my " labour fruitless, it rained heavily. When I landed, my whole " frame was so completely benumbed, that we were under the neces-

" sity of stopping to kindle a fire, and to indulge my guides with " a smoke, after which we proceeded. At night a severe pain be-" tween my shoulders, and general chillness kept me from sleep-" ing. I rose, boiled my kettle, and made some tea ; then dried my " blanket, and substituted for my damp shirt a spare one in " which I had rolled my plants; but feeling no better, and being " unfortunately without medicine, I started ou foot at a little be-" fore four, and driving the horses before me, got into a profuse " perspiration which considerably relieved my sufferings.

" Near this spot was an Indian burying ground, certainly the " most curious I had yet seen. All the property of the deceased " was here deposited near their graves; their implements, garments, " and gambling articles. Even the favorite horse of the deceased " is not spared; it is customary to shoot the animal with a bow " and arrow, and suspend the skin, with the hoofs and skull, just " above the remains of his master. On the trees which are round " the burying place, small bundles may be seen, tied up in the " same manner as the provisions which they carry when travelling. " I could not learn whether this was intended as food for the dead " or propitiatory offerings to the divinities. Within the grave the " body is placed in a sitting posture, with the knees touching " the chin, and the arms folded across the chest. It is difficult to " obtain any information on these subjects, as nothing seems to " hurt the feelings of these people so much as alluding to their " departed friends."

The gun having received thorough repair, and many new plants having been collected in this interesting locality, Mr. Douglas returned to Fort Colville, having passed in the same mode as before the Barrier river ; for this, however, he suffered : he was two days confined to bed by fever and bodily pains, caused no doubt by having walked so much in wet clothes. During the rest of the month of May he made many excursions round Colville, and met with considerable success in collecting. He had since his arrival discovered a new *Pinus ponderosa*, on which he found the *Arcenthobium xycedric*, a parasitical plant existing also in southern Europe. The beautiful genus *Pentstemon* was also enriched by three new species, *P. scouler*, *P. vetustus*, and *P. speciosus.*

On the 5th of June he left Colville and descended with the boats to Wallander, an establishment just below Lewis and Clarke's Fork, then considered the key to the navigation of the upper Co-

lumbia. On the 16th when nearly ready for his journey to the Blue mountains we have a very amusing account of a nocturnal visit of rats (probably the *Neotoma occidentalis*,) to his tent.

" During the night I was annoyed by the visit of a herd of rats " which devoured every particle of seed I had collected, ate clean " through a bundle of dried plants, and carried off my soap-brush, " and razor ! As one was taking away my inkstand, which I had " been using shortly before, and which lay close to my pillow, " I raised my gun, which with my faithful dog, is always placed " under my blanket by my side, with the muzzle to my feet, and " hastily gave him the contents. When I saw how large and " strong a creature this rat was, I ceased to wonder at the " exploits of the herd in depriving me of my property. The " body and tail together measured a foot and a half; the back is " brown, the belly white ; while the enormous ears are each three " quarters of an inch long, with whiskers three inches in length, " and jet black.

His journey to the Blue Mountains, occupying nine or ten days, did not turn out so productive as he had expected. He encountered tremendous thunder-storms, his guide refused to descend the southern slopes, declaring that their horses would be stolen, and that they themselves would fall victims to the hatred of the Shoshonies, or the Snake tribe, who are always on bad terms with the Columbia Indians. Before retracing his steps, however, he had the pleasure of plucking specimens of that magnificent plant, the *Lupinaster macrocephalus* of Pursh, and of adding many new-species to the genera *Lupinus*, *Pedicularis*, *Pentstemon* and *Eriogonum*. *The Trifolium altissimum and T. plumosum* were also gathered, and last, though not least, the *Pæonia Brownii* now adorned his Herbarium.

On the 10th of July Mr. Douglas left Wallawalla, proceeding down stream in a small canoe with Indians. Being unable to procure any salmon from the natives, and his stock of provisions entirely failing, he was for the first time reduced to the necessity of trying Tartar fare, and had supped and breakfasted on horse-steaks and Columbia water, when to his inexpressible joy he met, below the Chutes, the loaded boats that were so far on their way for the interior posts. The meeting is thus noticed.

" Having halted at night below the Great Falls of the Columbia, " I saw smoke rising behind some rocks, and thinking it might be ' Indians fishing, walked thither in quest of salmon. Instead of

" their savage countenances, I found, however, to my great delight, " that it was the camp of the brigade from the sea. I cannot des- " cribe the feeling which seizes me, when after travelling some " weeks together with Indians, I meet a person whom I have known " before, or if even they are strangers, yet the countenance of a " Christian is at such times most delightful. In the present in- " stance I had the additional happiness of finding myself in the " society of those who had ever treated me with cordiality, and " who now seemed to vie with one another in acts of kindness to- " wards me. Observing my dejected and travel-worn plight, one " fetched me some water to wash with, another handed me a clean " shirt, and a third busied himself in making ready something " more palatable than carrion for my supper; while my old friends, " Messrs. McDonald and Work, handed me those best of cordials, " my letters from England!

(*To be continued.*)

ARTICLE XI.—*On the Silurian and Devonian Rocks of Nova Scotia.* By J. W. DAWSON, LL.D., F.G.S.

[Communicated to the Natural History Society of Montreal.]

In the peninsula of Nova Scotia, the formations older than the carboniferous system, which is there so largely developed, are represented by disturbed and partially metamorphosed beds, occupying a broad belt of country on the south-eastern or Atlantic coast, and certain irregular hilly tracts in the interior. These beds were described by me in a paper communicated to the Geological Society of London in 1849, and subsequently in my "Acadian Geology;" in which work will be found references to the labours of previous observers. These notices were confessedly very imperfect, owing to the difficulties of the formations them selves, the deficiency or bad state of preservation of the fossils, and the absence of sufficient suits of these for comparison. With the view of remedying these deficiencies, I have embraced such opportunities as have occurred to me since the publication of "Acadian Geology," to study these rocks in those parts of the country which appeared to promise the most satisfactory results. My collections of fossils have also been increased by contributions received from Dr. Webster of Kentville, who has long directed his attention to the New Canaan and Nictaux districts, which I have had the advantage of exploring under his guidance; from the Rev.

D. Honeyman,* who has carefully collected the fossils of the Arisaig section, and from Mr. C. F. Hart of Wolfville. Prof. Hall of Albany, has also kindly consented to apply his unrivalled knowledge of the palæozoic fauna of America to the determination of the fossils, and has enabled me to publish with this paper, his descriptions of the more important new species.

With these aids, though aware that the complete solution of all the difficulties of these deposits must await a systematic and detailed survey, I hope to fix with certainty the geological position of several important series of beds, and thus to afford some data for comparison with the formations of similar age in other countries.

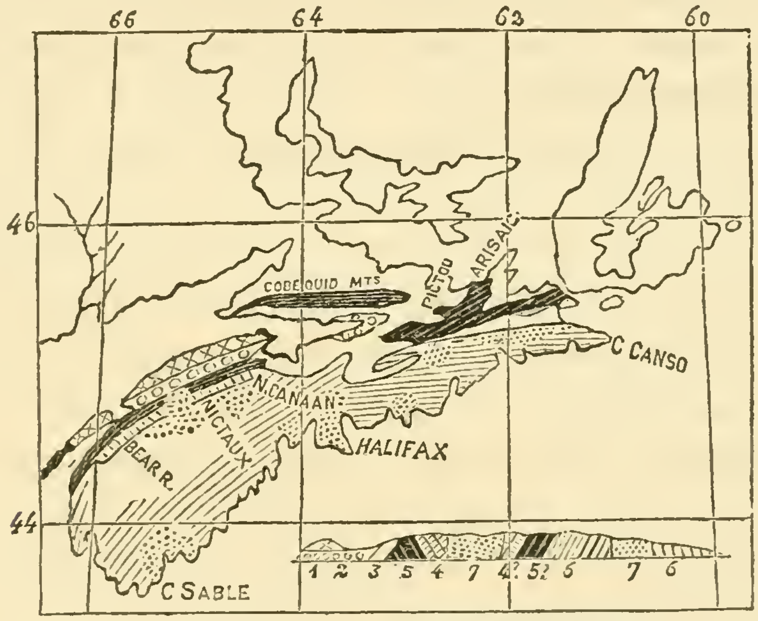


Fig. 1.—*Explanation of the Map and Section.*

(1) Secondary Trap.
(2) New Red Sandstone (Permian or Triassic.)
(3) Carboniferous.
(4) Devonian.
(5) Middle and Upper Silurian.
(6) Metamorphosed Lower Silurian.
(7) Granite.

The numbers refer to the section and to the accompanying shades of the map.

In my paper of 1849, I attempted to arrange the whole of these infra-carboniferous rocks of Nova Scotia, in two great divisions: (1.) The slate and quartzite formation of the Atlantic coast. (2.) The slaty, calcareous, and ferruginous formation of the inland hills. The second of these groups will be found in the sequel to include beds ranging from the Middle Silurian to the lower Devonian. The first is certainly older, and probably of Lower Silurian age.

* See also a paper by Mr. Honeyman, in the Transactions of the N. S. Lit. & Sci. Society.

I.—Lower Silurian.

The Atlantic coast series, which I regard as probably of this age, has afforded little that is new since my former publication on the subject. It extends continously, with prevailing east and west strike and northerly dip, from Cape Canso to the middle of the peninsula at Halifax Harbour. Thence it continues with prevailing north-east and south-west strike to the western extremity of the province. Its most abundant rocks are coarse clay slate and quartzite in thick beds. In some districts the slates are represented by mica-schist and gneiss, and interrupted by considerable masses and transverse bands of intrusive granite. It has afforded no fossils; but it appears to be the continuation of the older slate series of Mr. Jukes* in Newfoundland, which has afforded trilobites of the genus *Paradoxides*.† These fossils would indicate a position in the lower part of the Lower Silurian series, possibly on the horizon of the Potsdam sandstone or Lingula Flags. If so, the Lower Silurian limestones are either absent or buried by the unconformable superposition of the next series, or of the carboniferous beds which in some places immediately adjoin these older rocks.

It is however proper to state that on a comparison of these rocks with the series of altered deposits from Eastern Canada, collected by the Canadian Survey, and elaborately examined by Mr. Sterry Hunt, they appear more nearly to resemble those of the Hudson River group than any other of the series. It seems also, that chiastolite and staurotide, which occur abundantly in some parts of the Nova Scotia coast series, as for example, at Cape Canseau and in Shelburne, are characteristic in Canada and New England of altered Upper Silurian and Devonian rocks. It is possible that this last fact may be accounted for by the local occurence of some beds newer than the others; and the characters of the Silurian and Devonian series, as seen elsewhere in Nova Scotia, seem at least to exclude the mass of these coast rocks from any formation newer than the Middle Silurian.

II.—Middle and Upper Silurian.

The inland group of metamorphic rocks is more variable in its character, presenting many varieties of shales and slates some-

*Survey of Newfoundland.

† Salter, Proceedings Geological Society of London, 1859.

times talcose and chloritic, often coarse and arenaceous, and associated with beds of sandstone and quartzite, and with calcareous layers. In some districts there are also extensive beds which have the appearance of interstratified igneous products both of hornblendic and felspathic composition. The associated igneous rocks are granite (which appears to be continuous with that of the coast series and intrusive), syenite, diorite, porphyry and compact felspars. The more highly altered portions are penetrated by numerous veins of peroxide and carbonate of iron, with copper and iron pyrites.

These beds, as well as the overlying Devonian series, have been thrown into folds, varying in direction from east and west to north-east and south-west, and have been at the same time much altered and disturbed by plutonic rocks. They afterwards suffered extensive denudation, forming both anticlinal and synclinal valleys, in which were deposited beds of the carboniferous system, and of the New Red Sandstone of Nova Scotia, a deposit still of uncertain age.* This denudation has apparently been so complete as to remove from view nearly all the softer and least altered beds, the remains of which appear principally at the margins of the valleys now filled by the carboniferous series. Even in these exceptional spots they have in some instances been farther obscured by trappean eruptions of carboniferous or later date. The following are the principal localities in which I have been able to obtain determinable fossils. The geographical position of these points is noticed in the accompanying map. (Fig. 1, p. 132.)

Arisaig.

Near this place, at the extreme northern limit of the Silurian system on the eastern coast of Nova Scotia, is one of the most instructive sections of these rocks in the province. At the eastern end of the section, where they are unconformably overlaid by lower carboniferous conglomerate and interstratified trap,† the Silurian rocks consist of gray and reddish sandy shales and coarse limestone bands dipping south at an angle of 44°. The direction of the coast is nearly east and west, and in proceeding to the eastward, the dip of the beds turns to south 30° west, dipping 45°,

* See Journal Geol. Society, Vol. 4, and Acadian Geology.

† See papers by the author in Proceedings Geological Society, 1843-4.

so that the series, though with some faults and flexures, is on the whole descending, and exhibits in succession to the rocks just mentioned, gray and dark shales, with bands and lenticular patches of coarse limestone, some of which appear to consist principally of brachiopodous shells *in situ*, while others present a confused mass of drifted fossils. Below these the beds become more argillaceous, and in places have assumed a slaty structure, and occasionally a red colour. The thickness of the whole series to this point was estimated at 500 feet. The dip then returns to the south, and the beds run nearly in the strike of the shore for some distance, when they become discoloured and ochraceous, and then red and hardened; and finally, at Arisaig pier, are changed into a coarse reddish banded jasper, where they come into contact with a great dyke of augitic trap of carboniferous date. Beyond this place they are much disturbed, and so far as I could ascertain, destitute of fossils. The alteration of the beds extends to a distance of 300 yards from the trap, and beyond this in some places slaty cleavage and reddish colours have been produced; the latter change appearing to be connected with vertical fissures traversing the beds.

In the lower or shaly portion of the Arisaig series, the characterstic fossils are *Graptolithus* not distinguishable from *G. clintonensis*, *Leptocœlia* (*Atrypa*) *intermedia*, (Hall,) a new species closely allied to *L. hemispherica* of the Clinton group of New York, *Atrypa emacerata*, *Orthis testudinaria*, *Strophomena profunda*, *S. rugosa*, *Rhynconella equiradiata*, *Avicula emacerata*, *Tentaculites*, allied to or identical with *T. distans*, *Helopora* allied to *H. fragilis*. There are also abundant joints and stems of crinoids, and a *Palæaster*, the only one as yet found in Nova Scotia, which was presented to me by Mr. Honeyman, and has been described by Mr. Billings in the Canadian Naturalist under the name of *P. parviusculus*. These and other fossils associated with them, in the opinion of Prof. Hall, fix the Geological position of these rocks as that of the Clinton group, the upper Llandovery of Murchison, at the base of the upper Silurian or top of the middle Silurian.

In the upper and more calcareous part of the series, fossils are very abundant, and include species of *Calymene*, *Dalmanites*, *Homalonotus*, *Orthoceras*, *Murchisonia*, *Clidophorus*, *Tellinomya*, and several brachiopods, among which are *Discina tenuilamellata*, *Lingula oblonga*, *Rhynconella quadricosta*, *R. Saffordi*, (Hall,)

allied to *R. Wilsoni*, *R. neglecta*, *Atrypa reticularis*,* all found in the upper part of the Middle Silurian or in the Upper Silurian elsewhere in America. Most of the other forms are new species, descriptions of which will be found in Prof. Hall's paper appended to these notes. The general assemblage is on the whole like that of the Clinton, but is of such a character as to warrant the belief that we may have in these beds a series somewhat higher in position, and probably of Upper Silurian age. The new species *Chonetes Nova-Scotica* is very characteristic of the upper member.

On the whole we must regard the Arisaig series as representing the upper part of the Middle Silurian, probably with a part of the Upper Silurian, a position much lower than that assigned to it in my Acadian Geology, which was, however, at the time, based on the opinions of the best palæontologists who had examined specimens from these rocks. Unfortunately the Arisaig series stands alone, wedged between carboniferous and plutonic rocks, so that no opportunity occurs on the coast of verifying these conclusions derived from fossils, by the evidence of stratigraphical connection with newer or older Silurian deposits, and I have been unable to devote sufficient time to this object to attempt to trace the beds in their succession or continuation inland.

East River of Pictou.

The next example of fossiliferous Silurian rocks known to me is on the east branch of the East River of Pictou, and its vicinity, where these deposits rise from beneath the lower carboniferous series, forming the high ground on the eastern side of the river. The beds are here much altered and penetrated by igneous dykes, and are vertical, with very high southerly dips and N. E. and S. W. strike. They consist of coarse slates and calcareous bands resembling those of the upper Arisaig series in mineral character, and holding many of the same species, especially *Chonetes Nova-Scotica*; but we have here in addition a great bed of fossiliferous peroxide of iron, in some parts forty feet in thickness, and with oolitic structure; but passing into a ferruginous sandstone, and associated with slate and quartz rock. The age of these rocks relatively to the Arisaig series, it is not easy to determine. The stratigraphical evidence, though obscure, would place them in a higher position. The fossils are in a bad state of preservation; but in so far as

* Also *Strophomena corrugata*.

they give any information, it coincides with the apparent relation of the beds. Similar ferruginous beds occur in the Clinton series, (the Surgent of Rogers) in New York and Canada; and as we shall find in the sequel, in a much higher position in the western part of Nova Scotia. On the whole I regard the beds seen at the East River of Pictou as belonging to the same line of outcrop with the Arisaig series, but as containing in addition to the upper member of that series, beds higher in the Silurian system, or perhaps Lower Devonian.

Cobequid Mountains.

At the eastern end of this chain, in Earlton and New Annan, though the rocks are generally in a highly metamorphosed condition, fossils are found in a few places; and in so far as I have been able to determine from very small suites of specimens, are those of the upper Arisaig series. From the apparent continuity of strike along this long salient line of outcrop, it seems probable that these fossils indicate the true age of the greater part of the sedimentary rocks of the Cobequid hills; a conclusion confirmed by their similarity in mineral character to the altered equivalents of the Arisaig and East River series as seen elsewhere. The arrangement of the beds and their mineral contents in the central part of the chain, will be found noticed in my paper of 1849, already referred to. They are not known to contain beds of iron ore; but have enormous vein-like deposits of spathic and specular iron associated with the carbonates of lime and magnesia, and running with the strike of the beds.

New Canaan.

Between the East River of Pictou, and New Canaan in King's county, 100 miles distant, I know no Silurian beds with fossils; and in the central part of the province these rocks disappear under the carboniferous deposits. In the hills of Horton and New Canaan they reappear, and constitute the northern margin of a broad belt of metamorphic and plutonic country, occupying here nearly the whole breadth of the peninsula. The oldest fossiliferous beds seen are the fine fawn-coloured and gray clay slates of Beech Hill, in which Dr. Webster, many years since, found a beautiful *Dictyonema*, the only fossil they have hitherto afforded. It is a new species, closely allied to *D. retiformis* and *D. gracilis* of Hall, and will be described by that palæontologist under the name of *D. Websteri*, in honour of its discoverer. In

the mean time I may merely state that it is most readily characterised by the form of the cellules, which are very distinctly marked in the manner of *Graptolithus*. A portion of a frond is represented in Fig. 2.

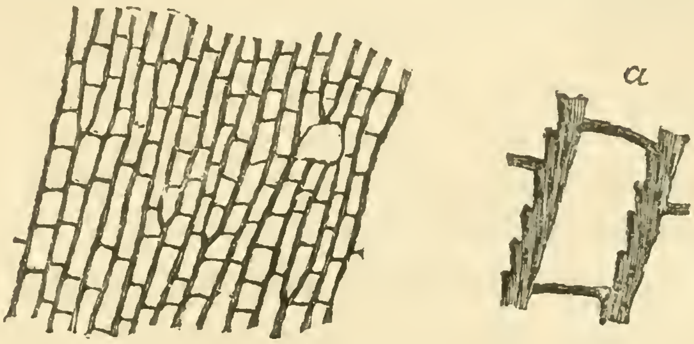


Fig. 2.—Part of frond of *Dictyonema Websteri*, Hall. *a*, portion magnified.

The Dictyonema slates of Beech Hill are of great thickness, but have in their upper part some hard and coarse beds. They are succeeded to the south by a great series of dark coloured coarse slates, often micaceous, and in some places constituting a slate conglomerate, containing small fragments of older slates, and occasionally pebbles of a gray vesicular rock, apparently a trachyte. In some parts of this series there are bands of a coarse laminated magnesian and ferruginous limestone, containing fossils which, though much distorted, are in parts still distinguishable. They consist of joints of crinoids, casts of brachiopodous shells, trilobites and corals. Among the latter are two species of *Astrocerium*, not distinguishable for *A. pyriforme* and *venustum* of the Niagara group, and a *Heliolites* allied to *H. elegans*, if not a variety of this species. On the evidence of these fossils and the more obscure remains associated with them, Prof. Hall regards these beds as equivalents of the Niagara formation of the New York geologists, the Wenlock of Murchison. Their general strike is N. E. and S. W.; and to the southward, or in the probable direction of the dip, they are succeeded, about six miles from Beech Hill, by granite. They have in general a slaty structure coinciding with the strike but not with the dip of the beds, and this condition is very prevalent throughout this inland metamorphic district, where also the principal mineral veins usually run with the strike. The beds just described run with S. W. strike for a considerable distance, and are succeeded in ascending order by those next to be described.

III.—Devonian.

It is probable that Devonian rocks, in a metamorphosed state

are extensively distributed throughout the districts now under consideration; but the only localities in which they have been clearly recognised, are along a line of outcrop on the northern margin of the hilly region westward of New Canaan. The first and most important of these exposures is at

Nictaux.

At this place, 20 miles westward of New Canaan, the first old rocks that are seen to emerge from beneath the New Red Sand stone of the low country, are fine-grained slates, which I believe to be a continuation of the Dictyonema slates of Beech Hill. Their strike is N. 30 to 60 E., and their dip to the S. E. at an angle of 72°. Interstratified with these are hard and coarse beds, some of them having a trappean aspect. In following these rocks to the S. E, or in ascending order, they assume the aspect of the New Canaan beds; but I could find no fossils except in loose pieces of coarse limestone, and these have the aspect rather of the Arisaig series than of that of New Canaan. In these, and in some specimens recently obtained by Mr. Hart, I observe *Orthoceras elegantulum*, *Bucania trilobita*, *Cornulites flexuosus*, *Spirifer rugæcosta?* and apparently *Chonetes Nova-Scotica*, with a large *Orthoceras*, and several other shells not as yet seen elsewhere. These fossils appear to indicate that there is in this region a continuance of some of the upper Arisaig species nearly to the base of the Devonian rocks next to be noticed.

After a space of nearly a mile, which may represent a great thickness of unseen beds, we reach a band of highly fossiliferous peroxide of iron, with dark coloured coarse slates, dipping S. 30° E. at a very high angle. The iron ore is from 3 to 4½ feet in thickness and resembles that of the East River of Pictou, except in containing less silicious matter. The fossils of this ironstone and the accompanying beds, as far as they can be identified, are *Spirifer arenosus*,* *Strophodonta magnifica*, *Atrypa unguiformis*,

* There is in the iron ore and associated beds another and smaller *Spirifer* as yet not identified with any described species, but eminently characteristic of the Nictaux deposits. It is usually seen only in the state of casts, and often strangely distorted by the slaty structure of the beds. The specimens least distorted may be described as follows: General form, semi-circular tending to semi-oval, convexity moderate; hinge line about equal to width of shell; a rounded mesial sinus and elevation with about ten sub-angular plications on each side; a few sharp growth ridges at the margin of the larger valves. Average diameter about one inch; mesial sinus equal in width to about three plications. I shall call this species, in the meantime, *S. Nictavensis*.

Strophomena depressa, and species of *Avicula*, *Bellerophon*, *Favosites*, *Zaphrentis*, &c. These Prof. Hall compares with the fauna of the Oriskany sandstone; and they seem to give indubitable testimony that the Nictaux iron ore is of Lower Devonian age.

To the southward of the ore the country exhibits a succession of ridges of slate holding similar fossils, and probably representing a thick series of Devonian beds, though it is quite possible that some of them may be repeated by faults or folds. Farther to the south these slates are associated with bands of crystalline greenstone and quartz rock, and are then interrupted by a great mass of white granite, which extends far into the interior and separates these beds from the similar, but non-fossiliferous rocks on the inner side of the metamorphic band of the Atlantic coast. The Devonian beds appear to dip into the granite, which is intrusive and alters the slates near the junction into gneissoid rock holding garnets. The granite sends veins into the slates, and near the junction contains numerous angular fragments of altered slate.

Westward of the Nictaux River, the granite abruptly crosses the line of strike of the slates, and extends quite to their northern border, cutting them off in the manner of a huge dyke, from their continuation about ten miles further westward. The beds of slate in running against this great dyke of granite, change in strike from south-west to west, near the junction, and become slightly contorted and altered into gneiss, and filled with granite veins; but in some places they retain traces of their fossils to within 200 yards of the granite. The intrusion of this great mass of granite without material disturbance of the strike of the slates, conveys the impression that it has melted quietly through the stratified deposits, or that these have been locally crystallised into granite *in situ*.

Moose River.

At this place the iron ore and its associated beds recur on the western side of the granite before mentioned, but in a state of greater metamorphism than at Nictaux. The iron is here in the state of magnetic ore, but still holds fossil shells of the same species with those of Nictaux.

Bear River.

On this stream, near the bridge by which the main road crosses it, beds equivalent to those of Nictaux occur with a profusion

of fossils. The iron ore is not seen, but there are highly fossiliferous slates and coarse arenaceous limestone, and a bed of gray sandstone with numerous indistinct impressions apparently of plants. In addition to several of the fossils found at Nictaux, these beds afford *Tentaculites*, an *Atrypa*, apparently identical with an undescribed species very characteristic of the Devonian sandstones of Gaspé, and a coral which Mr. Billings identifies with the *Pleurodictyum problematicum*, Goldfuss, a form which occurs in the Lower Devonian in England, and on the continent of Europe.

Westward of Bear River, rocks resembling in mineral character those previously described, extend with similar strike, but in an altered condition, and in so far as I have been able to ascertain, destitute of fossils, quite to the western extremity of the peninsula, where they turn more to the southward, and are as I suppose, repeated by a sharp synclinal fold, after which they are succeeded by the Atlantic coast series, consisting of quartzite and clay slate, with chlorite and hornblende slates at Yarmouth and its vicinity, and further to the S. E. of mica slate and gneiss.

General Remarks.

The above facts show that we can recognise among the partially metamorphosed sub-carboniferous rocks of Nova Scotia, formations ranging from the Middle Silurian to the Lower Devonian inclusive; but of a more argillaceous and less calcareous character than the series occupying this position in the mainland of America. The principal masses of plutonic rock associated with these beds, and especially the granite, are of newer Devonian date; but there is evidence of igneous eruptions as far back as the beginning of the Upper Silurian, and of the continuance or recurrence of such action as late as the carboniferous period. In and near the non-calcareous Lower Silurian series, granite prevails, almost to the entire exclusion of other plutonic rocks. At a greater distance from these, the plutonic rocks penetrating the Upper Silurian and Devonian series, though apparently of nearly the same age with the granite, are principally syenite and greenstone.

With respect to the general arrangement of the formations, though I cannot venture to speak with confidence on this point, with reference to a district so much disturbed, and which I have been able only very imperfectly to explore, I may suggest, as at

present the most probable arrangement, that represented in the little section attached to the map. The coast series would thus belong to an anticlinal, bringing up Lower Silurian rocks. On these, in proceeding to the north-west, rest middle and upper Silurian and perhaps Devonian beds in a metamorphosed condition, which along the northern margin of the metamorphic district rise again with an opposite dip, at Arisaig, East River, New Canaan, &c., forming a trough, the middle of which, in the east, is divided by a secondary anticlinal and filled with carboniferous rocks, but in the west is occupied with a great mass of granite into which the beds appear to have sunk in the direction of their dip. Beyond the northwestern edge of this trough, the Silurian beds probably again dip to the northward, but are hidden by carboniferous deposits, and reappear in another anticlinal with east and west strike in the Cobequid Mountains.

Rocks similar in character and relations to those above described are extensively distributed in the Island of Cape Breton and also in New Brunswick, but I have no detailed knowledge of their distribution. The formations described in this paper, represent in age, and resemble in their state of alteration, many portions of the metamorphosed Silurian and Devonian rocks of New England and Eastern Canada. In the latter, the relations of the intrusive granite and the middle and upper Silurian rocks as described by Sir William Logan, and as I have observed them in a few localities, strikingly resemble the phenomena observed in Nova Scotia.

I have no doubt that a detailed survey of these rocks in Nova Scotia and Cape Breton, would develop many curious and intricate disturbances, and might also ascertain the presence of members of the Silurian series, now supposed to be absent, but which may be only obscured by denudation. In the mean time local observers can do much to increase our knowledge of these rocks by carefully collecting the few fossils that remain unobliterated in the semi-metamorphic beds, and the above remarks may serve to guide such explorations, and to enable geologists to speak with more confidence than heretofore of the older palæozoic rocks of an important region of eastern America.

ARTICLE XII.—*Descriptions of New Species of Fossils from the Silurian Rocks of Nova Scotia.* By James Hall.

1. Crania acadiensis. N. sp. Fig. 1.

Circular or broadly sub-oval, moderately convex, the greatest convexity near the apex; apex obtuse.

Several casts show a central elevated area, with strong muscular impressions; the more elevated portion being surrounded by a flattened border, which is radiatingly striate.

These specimens are casts which appear to be of the ventral valve; and the form of the muscular impressions is so characteristic of the genus that I can have little hesitation in thus referring them.

2. Discina tenuilamellata. Var. *subplana.*

Shell broadly elliptical, or suborbicular, externally depressed, apex subcentral; surface marked by thin sharply elevated lamellæ.

This closely resembles the Niagara species of New York, but may be distinct. Should further examination prove it a distinct species, the name *D. subplana* may be adopted.

Fig. 2.

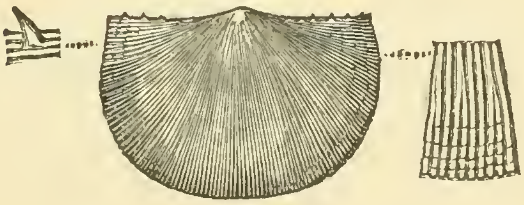


Fig. 3.

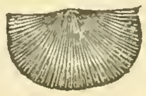


Fig. 1.

Fig. 5.

Fig. 4.

3. Chonetes Nova-Scotica. N. sp. Fig. 2.

Shell semielliptical, width varying from once and a half to nearly twice the length. The ventral valve variably convex, and often showing a flattened or slightly concave space down the middle of the shell; cardinal margin ornamented by four or five minute spines on each side of the beak; cardino-lateral margins often a little wrinkled; surface finely striated, striæ flexuous, dichotomising and increasing by interstitial addition, so that there are more than one hundred on the margin of the shell; striæ increasing in size below the umbo; concentric striæ fine, close, rounded and slightly undulating.

Dorsal valve moderately concave; striæ much stronger below the middle of the shell and sometimes bifurcating toward the margin.

This species resembles in form the *Chonetes cornuta* of the Clinton group of New York, but is a much larger and more ventricose shell; the striæ are proportionally less numerous and more closely arranged, the interstices being less than the striæ, while in the *C. cornuta* the interstices are wider than the striæ, and the latter increase only by interstitial additions below the middle of the shell. A stronger and more elevated stria often marks the median line from beak to base of the ventral valve.

4. Chonetes tenuistriata. N. sp. Fig. 3.

Shell semi-oval, twice as wide as long; ventral valve moderately convex, hinge line equalling the width of the shell; surface marked by fine, even, closely arranged striæ, which apparently increase only by interstitial additions, and are not flexuous. The number of striæ on the margin of the shell is nearly one hundred.

This species is more finely striated than the preceding, the striæ not flexuous, more even, and in shells of equal size much more numerous. This species is somewhat larger and more closely striated than the *C. cornuta* of the Clinton group of New York.

5. Spirifer rugæcosta. N. sp.

Shell somewhat semi-elliptical; dorsal valve very convex, with the mesial fold depressed along the centre; ventral valve with a wide deep mesial sinus; plications six or seven on each side of the mesial fold and sinus, strong, and much elevated, subangular, crossed by numerous strongly elevated, lamellose, imbricating concentric striæ.

The specimens examined are almost all imperfect casts, some of which preserve the impression of the strong concentric striæ, and in one or two specimens an impression of the shell reveals the strength of the surface markings.

In many respects this species resembles the *S. perlamellosa* of the lower Helderberg group in New York, but the mesial elevation of this species is flattened or depressed, a character never observed in New York specimens.

6. Spirifer subsulcatus. N. sp.

Shell semi-elliptical, hinge line equalling or greater than the length of the shell below; plications five or six on each side of the

mesial fold; mesial fold somewhat flattened or very slightly rounded on the summit; plications rounded; surface concentrically lamellose.

The specimens are all casts, or impressions of the shells.

They bear some resemblance to *S. sulcatus* of the Niagara group, and are intermediate between that species and the *S. cycloptera* of the Lower Helderberg group.

7. Tremastospira Acadiæ. N. sp. Fig. 4.

Shell wider than long; beak of the ventral valve produced and incurved; mesial depression marked by a small fold on each side, which originates about one-third of the length below the beak and continues to the margin; sinus bounded on each side by a more strongly elevated plication, beyond which are six other plications on each side.

Surface marked by fine concentric striæ.

This shell is referred to the genus *Trematospira* from external characters alone, which are unlike *Rhynchonella* proper, and the shell is not a *Spirifer.*

8. Rhynchospira sinuata. N. sp.

Shell ovoid, ventricose beak of the ventral valve incurved; a mesial sinus beginning a little below the beak; surface marked by about eight or nine simple scarcely subangular plications on each side the mesial sinus.

Surface marked by concentric lines of growth.

This species differs from the *R. formosa* of the Lower Helderberg rocks of New York in the plications being more slender, in the more defined sinus of the ventral valve, and the continuation of the two small folds in the sinus nearly to the beak.

9. Rhynchonella Saffordi.

Shell varying in form from ovoid to globose. Full grown specimens usually wider than long, and sometimes becoming extremely ventricose, so that the diameter across the two valves much exceeds the length. Ventral valve depressed convex, with the beak minute, closely incurved; dorsal valve very ventricose, most prominent toward the front. Cardinal slope a little depressed, sides rounded, and the front in direct line flattened but not depressed. Surface finely plicated, plications little elevated,

rounded or scarcely subangular, about five or six depressed in the flattened sinus of the ventral valve and a corresponding number raised on the flattened mesial elevation, which rises abruptly though usually but slightly above the lateral portions of the shell. From ten to fourteen plications mark the surface on each side of the mesial fold and sinus. Plications in front marked by a sharp groove along the centre, and those of each valve deeply interlocking.

This species resembles the *R. nucleolata* of the Lower Helderberg rocks of New York, and in some specimens it approaches to *R. ventricosa*, but is always much more finely plicated than either. It closely resembles the *R. Wilsoni* of Europe in its general form, but the plications are more rounded and somewhat coarser, and while in that species the sinus causes no depression in the ventral valve below the general surface of the shell, in ours there is an abrupt depression as well as a slightly abrupt elevation on the dorsal valve, while there is no similar feature in the *R. Wilsoni.**

The Nova Scotia specimens are in all respects identical with those from Tennessee.

The geological position of the specimen from Tennessee is in rocks of the age of the Lower Helderberg group, associated with *Pentamerus galeatus*, *P. Verneuili*, *Spirifer macropleura*, *Spirifer perlamellosa*, *Spirifer cycloptera*, and others.

10. Leptocelia intermedia. Fig. 5. N. sp.

Shell concavo-convex; outline semi-elliptical, cardinal extremities rounded, and the hinge-line a little shorter than the greatest width of the shell; ventral valve moderately convex, carinate in the middle by a strong plication, with six or seven smaller ones on each side, the lateral ones slightly curved towards the outer extremity. Dorsal valve concave, with a broad shallow mesial sinus, the margins on either side being bent a little upward, giving a sinuous outline to the margin of the shell; surface marked by fine concentric striæ.

This species resembles the *L. hemispherica* of the Clinton group in New York, in general form, but the hinge-line is shorter and the extremities rounded; the mesial elevation consists of a single strong plication, while in *L. hemispherica* the surface is regularly plicated, with the central one sometimes a little stronger than the others.

*Sowerby, M. C., vol. ii., page 38, says: The "sinus at the front, although deep, does not alter the evenness of the surface."

11. Modiolopsis? rhomboidea. N. sp. Fig. 6.

Shell sub-rhomboid, rounded in front, wider and obliquely truncate behind, hinge-line slightly ascending from the anterior end; beaks subterminal, posterior umbonial slope obtusely subangular below, anterior to which the shell is flattened; basal margin nearly straight, the shell gradually widening behind and the posterior basal extremity abruptly rounded. Surface evenly striated concentrically.

Anterior muscular impression very strong, posterior muscular impression less strongly defined, but still very conspicuous and sub-duplicate; palleal line simple, nearly parallel to the basal margin, strongly and almost equally defined in all parts of its length between the two muscular imprints.

This shell bears some resemblance to *M. primigenius*, but is less ventricose in the middle, and the sub-angular umbonial slope is not so well defined in that species.

12. Modiolopsis sub-nasutus. N. sp.

Shell elongate sub-spatulate, the length being more than twice the greatest width hinge-line; slightly ascending posteriorly; beaks sub-anterior, the anterior end very narrow, gibbous on the umbones, with a sub-angular ridge on the umbonial slope which extends to the postero-basal angle; basal margin nearly straight, the posterior end somewhat flattened and obliquely sub-truncate at the extremity; surface marked by concentric lines of growth.

This shell bears a close general resemblance to *M. nasutus* of the Trenton limestone, but a careful comparison shows it to be wider and more abrupt at its posterior termination, while the direction of the striæ of growth is very distinctive, these marks being regularly curving toward the posterior end in *M. nasutus*, while in this species they are abruptly bent at the postero-basal angle, and again on the cardinal side, corresponding with the truncate posterior extremity of the shell.

13. Clidophorus cuneatus. N. sp.

Shell ovoid, gibbous in the middle and on the umbones, gradually declining behind; beaks anterior, sub-terminal; anterior end broadly rounded, the posterior end narrower and sub-acute, posterior umbonial slope marked by an obtuse rounded ridge, which extends to the posterior extremity, and below this an unde-

fined sinus which, expanding, extends to the postero-basal extremity, while a less defined ridge bounds this sinuosity on its anterior side; surface marked by fine irregular concentric striæ.

In the casts of this shell there is a strong linear straight clavicle, extending from a point just anterior to the beak two-thirds across the valve.

Fig. 6.

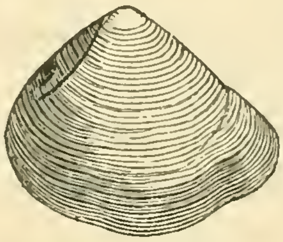


Fig. 7.

Fig. 8.

14. Clidophorus concentricus. N. sp. Fig. 7.

Shell sub-equilateral, very broadly oval-ovate, the anterior end the broader; height nearly four-fifths the greatest length; anterior side a little shorter and more broadly rounded at the extremity; a slight depressed sinus on the posterior umbonial slope, which is more anterior than in the preceding species. Surface marked by even band-like concentric striæ; shell thin; a linear curving clavicle extends from the cardinal line just anterior to the beak more than half way to the base.

The prominent points of distinction between this and the preceding shell are the nearly central beaks, the band-like striæ, and the curving clavicle with the broad and nearly equal extremities of the valve.

15. Clidophorus erectus. N. sp. Fig. 8.

Shell somewhat rhomboid-ovate, the height and length about equal; umbones prominent, beaks nearer the anterior end, somewhat curved and elevated; posterior cardinal line curving, with a scarcely defined ridge along the umbonial slope; basal margin strongly rounded, sinuate on the postero-basal margin and regularly rounded, with a scarcely defined ridge extending down the slope just anterior to the clavicle. Surface finely striated concentrically, a slightly curving clavicle extending from the cardinal line nearly two-thirds the distance to the anterior basal margin.

This species differs from the preceding in the equal length and breadth and consequent greater proportional height, in the sinuosity of the postero-basal margin, and more abruptly-rounded basal outline, and the curving forward of the beaks.

16. Clidophorus elongatus. N. sp. Fig. 9.

Shell sub-elliptical, length about twice the height, beaks much nearer to the anterior end, which is narrowly rounded; umbones rounded, prominent; a defined gradually widening depression extends from the umbo to the posterior basal margin, causing a straightening or slight sinuosity in the edge of the shell; a defined ridge along the posterior slope between the sinus and the cardinal margin. Surface very finely striated. A slender clavicle extends from the anterior cardinal margin a little more than half-way to the base, and curving slightly forward.

This species differs externally from all the others in the greater proportional length and in the rounded umbones.

The *C. cuneatus* of the same size is a stronger and proportionally higher shell, having a less defined sinus on the posterior slope, and a much stronger clavicle.

Fig. 9.

17. Clidophorus semiradiatus. N. sp.

Shell somewhat oval-ovate, length about one third greater than the height.

Surface marked by fine concentric band-like striæ, and the posterior slope by flattened dichotomized radiating striæ, the two sets of striæ gradually dying out at their junction. A faint line anterior to the beak marks the place of the clavicle.

18. Clidophorus nuculiformis. N. sp.

Shell nearly equilateral, subventricose, height and length as seven to nine. Anterior end rounded, basal margin regularly curved; posterior end sub-acute, a slight flattening or depression along the posterior umbonial slope, and between this and the cardinal line a narrow ridge. On the anterior slope there is a depressed line almost parallel to the cardinal line, marking apparently the course of the clavicle. Surface marked by fine concentric striæ.

This species resembles in form the *C. concentricus* in its equilateral form, but the fine unequal concentric striæ and the difference in direction of the clavicle are sufficient to distinguish it.

19. Clidophorus subovatus. N. sp.

Shell, broadly oval or ovate, moderately and evenly convex; beaks near the anterior end; umbones moderately elevated; a scarcely defined depression extending from the umbo towards the postero-basal extremity; anterior extremity rounded, posterior extremity unknown (? regularly rounded); clavicle extending half way from the anterior cardinal margin to the base of the shell. Surface marked by fine unequal sub-lamellose striæ.

This shell is larger and more regularly convex than any of the others here described, and more inequilateral than any except the *C. cuneatus.*

20. Nuculites [Orthonota] carinata. N. sp. Fig. 10.

Shell extremely elongate, nearly three times as long as wide; sides sub-parallel; hinge line straight, beaks appressed, sub-anterior, the anterior extremity rounded; posterior extremity obliquely truncate, longer on the hinge line than on the basal margin. Surface marked by a sharp carina which extends from the umbo obliquely to the postero-basal angle, the space anterior to this carina marked by distinct elevated lamellose striæ, and intermediate finer ones. The space between this and the cardinal line smooth and slightly depressed. Cardinal line anterior to the beak showing six or seven crenulations. A strong clavicle extends from the anterior cardinal line with a gentle curve nearly to the base of the shell.

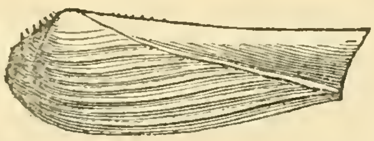


Fig. 10.

Fig. 11.

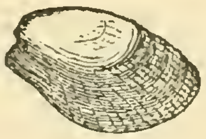


Fig. 12.

This shell presents characters not before observed combined in one species. It has the general form of *Orthonta*, while the crenulated cardinal line and the anterior clavicle are characters of *Nuculites.* The shell is readily distinguished from species of either genus heretofore described. The Orthonotæ, yet known, have the surface marking much less sharply defined.

21. Tellinomya attenuata. N. sp. Fig. 11.

Shell elongate, narrow, more than twice as long as high, anterior end short and rounded, beak elevated, situated a little in

advance of the anterior third, posterior end narrow and abruptly rounded; basal margin slightly curved, and impressed posterior to the centre; posterior cardinal line straight but gradually declining; contour evenly convex. Surface concentrically striated, shell thick.

This shell resembles the *T. machœriformis*, but the anterior end is proportionally longer and more regularly round, the posterior narrower and more attenuated, and the convexity of the shell much greater. It is much smaller and proportionally more elongated than the *T. nasuta* of the Trenton Limestone.

22. Tellinomya angustata. N. sp.

Shell elongate, narrow elliptical, more than twice as long as wide, beaks fully one third from the anterior end. The anterior and posterior ends similar and equally rounded; basal margin regularly curved without indentation or sinuosity. Surface evenly convex and very finely concentrically striated.

23. Leptodomus, (Sanguinolites,) aratus. N. sp.

Shell rhomboid-ovate, ventricose, beaks at the anterior third of the valve, incurved and pointed forward, umbones gibbous, a slight depression from the umbo directly to the base of the shell leaving a slight impression in the central margin; posterior slope sub-angular, the angle not defined; anterior slope with a defined angular ridge which borders a large cordiform lunette; anterior sharply rounded; basal margin nearly parallel with the hinge line, curving upwards at the posterior extremity, and somewhat obliquely truncated from the cardinal line. Cardinal line straight posteriorly, with a wide and deep ligamental area. Surface marked by strong unequal ridges and furrows parallel to the basal margin, which become obsolescent on the posterior cardinal slope.

It is scarcely possible to refer any fossil with satisfaction to the genera *Sanguinolites* or *Leptodomus* of McCoy, since the grouping of species under these names appears to us to comprise a heterogeneous assemblage in either case. Our shell corresponds in its external features with *Leptodomus costellatus* of McCoy, so far as the general form, surface markings, ligamental area, etc. and is doubtless generically identical with that shell.

24. Megambonia (?) cancellata. N. sp. Fig. 12.

Shell sub-ovate, widening posteriorly; beak anterior incurved, umbo gibbous, with a gibbous umbonial slope on the posterior side, which is scarcely diverging from the cardinal line; posterior extremity rounded, the basal margin arcuate, with a slight impression anterior to the middle, the anterior end a little gibbous. Surface cancellated by concentric and radiating elevated striæ.

It is not possible from the specimen before me to refer this species satisfactorily to any known genus.

25. Megambonia striata. N. sp.

Shell somewhat oval, the basal and cardinal lines nearly parallel; beak sub-anterior, small; umbones convex, scarcely gibbous; umbonial slope regularly convex, below which is a slight depression reaching to the postero-basal margin; posterior end rounded, the longer part of the curve on the basal side. Anterior end short and narrow, somewhat abruptly rounded. Surface marked by regularly radiating rounded striæ with faint concentric lines of growth.

This differs from the preceding species in being less gibbous, in the more nearly parallel cardinal and basal lines, in the direction of the umbonial ridge, and in the stronger radiating striæ.

24. Avicula Honeymani. N. sp. Fig. 13.

Left valve: body of the shell obliquely ovate, convex and somewhat gibbous towards the umbo, anterior wing small rounded, posterior wing large triangular, obtuse at the extremity, extending two-thirds the length of the shell. The line between the wing and body of the shell well defined by a slight abrupt depresssion along the junction. Surface marked by rounded radiating striæ which are interrupted by fainter concentric undulations or lines of growth; the wing is marked only by concentric striæ.

This species bears some resemblance to *A. emacerata* of the Niagara and Clinton groups of New York; but its form is slightly more oblique, and the wing is marked only by concentric striæ, while in the New York species the radiating lines on this part are stronger than the concentric ones.

25. Murchisonia Arisaigensis. N. sp.

Shell teretely conical, volutions about five, gradually increasing from the apex, rounded with a slight angulation or carina in the middle. The surface is unknown and the angular band on the volution is the only means of determining its generic relations.

This differs from any of the described species of Murchisonia from American localities.

26. Murchisonia aciculata. N. sp.

Shell slender, very gradually tapering, volutions about six or seven, the last ones moderately ventricose, aperture elongate-oval or ovate, rounded at the anterior margin, columella plain; volutions marked by a distinct band along the centre, and a sub-sutural carina marking the upper side of the volutions; surface striated.

Fig. 13.

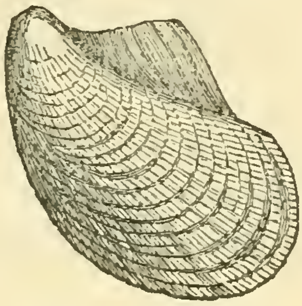
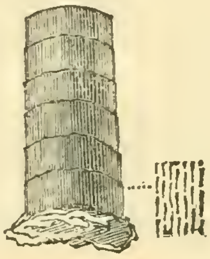


Fig. 14.

Fig. 15.



27. Holopea reversa. N. sp. Fig. 14.

Shell small, sinistral; spire depressed, volutions about three; the two first small and gradually expanding, the last one rapidly expanding and ventricose; aperture wide expanded; suture impressed. Surface unknown.

This shell has the general form of Holopea, but I have seen only a single specimen, which is a cast. It is remarkable and readily recognised from the sinistral spire.

28. Orthoceras punctostriatum. N. sp. Fig. 15.

Shell slender, very gradually tapering, almost cylindrical; Septa distant about one third the diameter. Siphuncle central; section circular. Surface very finely striated with unequal undulating striæ, the interstices between which, are punctæ which are oblong indentations often becoming confluent.

This species is remarkable for its extremely gently tapering form; the fragment of more than an inch long, showing scarcely a perceptible diminution in diameter. There are twelve and a half chambers in the space of one inch. The surface markings are peculiar, and among the species of the genus known to us constitute a distinctive character.*

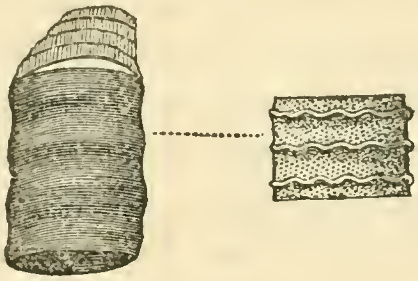


Fig. 16.

29. CORNULITES FLEXUOSUS. var. GRACILIS.

This fossil resembles the one in the Clinton group of New York, but is somewhat more slender, and the annulations a little more closely arranged. The specimens from the rocks of New York present some variation in form, and the comparative distance of the annulations. None of them, however, are so slender as the Nova Scotia specimens.

30. HOMALONOTUS DAWSONI. N. sp. Fig. 17.

Caudal shield somewhat parabolic, obtuse at the extremity, very convex, width at the anterior side greater than the length of the

* The Arisaig beds afford at least three other species of *Orthoceras*. One, the largest of the three, has a marginal inflated siphuncle, and the septa about one-eighth of an inch apart, for a specimen two inches in diameter. It tapers very gently, and in all the specimens found is elliptical in its cross section. It occurs in the upper series. A second, found in the lower series, is marked with strong annulations placed closely together. A third, occurring in the upper series, and discovered since the specimens were submitted to Professor Hall, is a very beautiful species, apparently new, but closely resembling *O. perelegans*, Salter, of the Lower Ludlow formation. It is cylindrical, but slightly flattened; septa very convex and one-twentieth of an inch apart in a specimen half an inch in diameter; siphuncle central. Surface with slight rounded annulations from one-eighth to one-fourth of an inch apart, and covered with delicate transverse striæ, scarcely visible to the naked eye, and about sixteen in a line. Under the microscope the striæ appear as thin sharp parallel curved ridges, the spaces between being finely granulated and wider than the ridges. I would name this species *O. elegantulum*.—J. W. D.

axis. Axis wider than the lateral lobes, distinguishable (in casts) from the lobes by a bending of the ribs and a scarcely perceptible depression along that line; annulations abruptly prominent; seven on the lateral lobes and nine on the axis, the anterior ones bending slightly backward at the line of division between the axis and the lateral lobe; each successive one bending more and more abruptly till the last one approaches a rectangular turn; the whole curving gently forward at their extremities, and all terminating abruptly before reaching the margin. Behind the seventh annulation the axis is marked by two more annulations, leaving nearly one-fourth of its length smooth.

This species is described from the casts and impressions of the caudal shield, so that the crustaceous covering is unknown. It is readily distinguished by the broad not prominent axis, the rectangular direction of the annulations on the axis, and their abrupt bending at the lateral furrow. An impression of a few imperfect annulations of the body shows that they are strongly elevated, much more so than in any known American species.

31. Calymene Blumenbachii. var.

Caudal shield somewhat semicircular, axis very prominent, marked by about seven annulations, lateral lobes marked by five ribs the four anterior ones bifurcating. Surface granulose. The specimens are not sufficient to make any satisfactory determinations regarding specific differences.

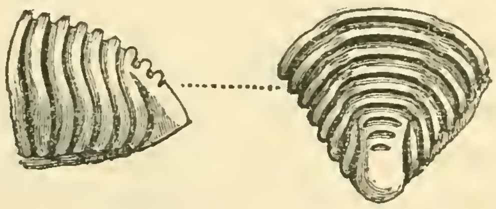


Fig. 17.

Fig. 18.

32. Dalmania Logani. N. sp. Fig. 18.

The specimens are two or three imperfect cephalic shields, one preserving the palpebral lobes, and others consisting principally of the glabella, with two or three parts of caudal shields. There is a fragment of a cheek which may be of this species. Cephalic shield somewhat semicircular. Glabella ovate, wider in front and truncate behind, depressed convex; occipital ring narrow, prominent; occipital furrow bending a little forward in the middle and curving gently backward in the middle of each side, and

again turning forward; posterior furrows narrow and sharply impressed, each one extending about one third across the glabella and curving forward at their outer extremities; central furrow linear, obscure, having a direction transverse to the axis; anterior furrow obscure oblique to the axis, linear, extending to the margin of the glabella a little forward of the eye; frontal lobe regularly rounded anteriorly. A fragment of a cheek in the same association is broad, produced posteriorly in a short strong spine, and marked by a broad sub-marginal groove. Caudal shield somewhat semi-elliptical, convex, acute behind, axis very prominent, rounded and marked by about eight annulations, which are gently curved backward at the extremities; lateral lobes with six simple flattened ribs which terminate in a thickened border, and separated from the axis by a strongly defined furrow; extremity abruptly pointed.

The glabella of this species more nearly resembles *Phacops* in the general form and faintly impressed furrows, of which the posterior one is conspicuous. The form of the palpebral lobe, and the absence of tubercles at the base of the glabella, together with the form of the caudal shield, ally it with *Dalmania*, and it may be compared with *D. Phillipsi* of Barrande, but has a more pointed caudal shield, and the cheek, if correctly referred, is prolonged in a posterior spine.*

33. Beyrichia pustulosa. N. sp. Fig. 19.

Valves unequally semi-oval, a little more than once and a half as long as wide; surface marked by three prominent ridges; central, anterior, and posterior. The central one is a single oblong oval tubercle which is directly transverse to the dorsal margin and a little nearer the anterior side. The anterior ridge consists of a single highly elevated, rounded or papillose tubercle near the dorsal margin, and an elongated elliptical tubercle placed obliquely near the antero-ventral margin, and in older specimens sometimes swelling and spreading over the margin. The posterior ridge rises near the dorsal margin, and making a slightly broader curve than the posterior end of the valve approaches the ventral margin at the centre: the ridge is high and angular with a small prominent

* Attached to a fragment of one of these trilobites is a small *Spirorbis*. It is dextral, with two to three turns, and rounded concentric wrinkles on the last whorl.—J. W. D.

tubercle at the dorsal extremity, and from four to six smaller spine-like tubercles along its curve. The central ridge or tubercle is separated from the lateral ridge by a distinct furrow, and its continuation from the base of the tubercle passes between the lower ends of the two lateral ridges. Ventral and lateral margins with a narrow thickened rim.

This species resembles very nearly the *B. tuberculata* of Kloden, as described and figured by Mr. T. Rupert Jones. In our specimens the dorsal angles are more rounded; the posterior ridge at its base is never extended beyond the middle of the valve, and is marked on its crest by several small spine-like tubercles. The anterior ridge is usually more extended along the ventral margin in our specimens, aud the furrow is better defined, while the tubercles are never flattened above or overhanging the base as shown in the European specimens. Smaller specimens, which appear to be the young of this species, present some slight variations of surface markings, but show less difference than the young of *B. tuberculata.*

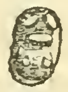


Fig. 19.

Fig. 20.

34. Beyrichia equilatera. N. sp. Fig. 20.

Nearly equilateral, very convex, marked by three smooth or nearly smooth ridges. The central ridge is an oblong tubercle reaching from near the dorsal margin a little more than half way to the ventral margin. The posterior ridge is a little larger, but scarcely differing in form from the anterior one, its ventral extremity terminating beneath or a little in advance of the middle of the central tubercle. The furrow is narrow but well defined on the two sides of the central tubercle, and becoming shallow in its passage to the marginal furrow; ventral and lateral margins thickened.

35. Leperdita sinuata. N. sp.

Minute sub-ovate, anterior end narrow, dorsal line one-third shorter than the length of the valve; an extremely minute tubercle near the anterior end. Centre extremely convex or ventricose; ventral margin near the posterior end a little sinuous, or indented from the inner-side. Surface smooth under an ordinary lens.

Two specimens only of this species have been observed, both of them having the same dimensions.

36. TENTACULITES DISTANS. var.

The specimens under examination do not present any important points of difference from those of the Clinton group in New York. In the Nova Scotia specimens there are numerous annulations near the apex, which are not observable in the New York specimens.

37. HELOPORA FRAGILIS, var. ACADIENSIS.

The specimens under examination offer no very important difference from those in New York, and as the Nova Scotia examples have been more or less compressed and worn, they are scarcely in a satisfactory condition for nice discrimination.

All the above fossils belong to the Arisaig series of Mr. Dawson's paper. Nos. 4, 10, 30, 36 and 37 appear characteristic of the dark and olive shales of the lower member, in which are also *Strophomena profunda*, *S. rugosa*, *Orthis testudinaria*, *Atrypa emacerata*, *Rhynconella equiradiata*, *Graptolithus Clintonensis*, and crinoidal columns; also a *Modiolipsis* allied to *M. subcarinatus.* The remaining species are in the coarse limestone and reddish shale of the upper member, in which are also *Strophomena corrugata*, *Atrypa reticularis*, *Rhynconella neglecta*, *Lingula oblonga*, *Bucania trilobita*, and a *Chætetes* or *Stenopora* similar to that of the Clinton formation. *Cornulites flexuosus* is almost the only species which occurs equally in both groups of beds. Some of the *Clidophori* are also found in both groups.

REVIEW.

NOTES of a Clerical Furlough, chiefly spent in the Holy Land, with a sketch of the voyage out in the Yacht "St. Ursula." By Robert Buchanan, D.D. Third thousand. Glasgow, Blackie & Sons: Montreal, B. Dawson & Son. pp. 437, with illustrative maps.

This book is written by one of the most esteemed and accomplished ministers of Glasgow, Scotland. It is the fruits of a voyage in the private yacht of Mr. Tennant, a wealthy manufac-

turer of that city. The incidents of the voyage are most agreeably related. The party landed at Alexandria in Egypt, and visited Cairo and the Pyramids, of which places the author gives most graphic descriptions. Returning to Alexandria, they went on to Jaffa—the ancient Joppa, the port of Palestine. From that place they journeyed to Jerusalem. At every prominent place, vivid and most interesting descriptive accounts are given of the physical appearances of the country, together with interesting notices of the historical events associated with the localites. Instead of entering Jerusalem by the Jaffa Gate, the travellers took a detour to the Mount of Olives, which after much fatigue, they reached at night-fall, and spent a cold and comfortless night in an upper room in the Mohammedan Mosque. This, however, was the finest point for viewing the city and its environs. In the morning they descended the Mount, and wended their way along the road which the Saviour frequently traversed on His journeys to and from Jerusalem. The remarkable spots on this route, and the language of Scripture which they illustrate, are carefully noted. We have read nothing more artistic and eloquent than the descriptive parts of this entrance into Jerusalem, Having spent some time in the sacred city, and having visited the Dead Sea and the River Jordan, our travellers extended their journey northward through the classic ground of Samaria, on to the sacred Sea of Galilee. Here, with loving reverence and deep emotion, they linger among the scenes in which so many of the Lord's wonderful miracles were wrought. They went on to Lake Merom and the sources of the Jordan; and visiting Damascus, they then crossed the range of Lebanon, and examining the ruins of Baalbec, passed on to Tripoli, where they embarked again for home. While this book aims only at a familiar narrative of what was seen and experienced in Palestine, it yet exhibits an extensive and accurate erudition. If not so elaborate, it is as accurate and critical as Stanley's. In his powers of impresssing the prominent features of a scene, with its most interesting accessories, vividly upon the mind of the reader, Dr. Buchanan excels any of the late writers on the Holy Land. We know of no more fascinating or delightful book of travels than this is, and would specially recommend it as most suitable for the family library.

A. F. K.

MONTHLY METEOROLOGICAL REGISTER, ST. MARTINS, ISLE JESUS, CANADA EAST, (NINE MILES WEST OF MONTREAL,) FOR THE MONTH OF FEBRUARY, 1860.

Latitude, 45 degrees 32 minutes North. Longitude, 73 degrees 36 minutes West. Height above the level of the Sea, 118 feet.

BY CHARLES SMALLWOOD, M.D., LL.D.

Day of Month.	Barometer—corrected and reduced to 32° F. (English inches.)			Temperature of the Air.—F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.			Direction of Wind.			Horizontal Movement in 24 hours. In miles.	OZONE. Mean amount of, in inches.	RAIN. Amount of, in inches.	SNOW. Amount of, in inches.	WEATHER, CLOUDS, REMARKS, &c. &c. [A cloudy sky is represented by 10, a cloudless one by 0.]		
	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.					6 a. m.	2 p. m.	10 p. m.
1	30.143	30.205	30.173	—25.0	—5.9	—11.1	.010	.026	.015	.64	.70	.55	N. E. by E.	S. S. W.	S.	7.23	0 5	....	....	Clear.	Clear.	Clear.
2	190	280	280	—11.6	12.1	2.1	.116	.039	.038	.56	.57	.73	N. E. by E.	S. E. by E.	N. E. by E.	6.52	0.6	....	....	Hazy.	Cirri 4.	Cu. Str. 16.
3	470	300	201	1.0	16.8	3.2	.032	.053	.042	.70	.68	.86	N. E. by E.	N. E. by E.	N. E. by E.	4.90	1.5	....	Inapp.	Cu. Str. 10.	Cu. Str. 4.	Cirr. Cum. 4. Lunar Halo.
4	141	197	053	1.0	17.9	10.9	.041	.068	.057	.85	.67	.79	N. E. by E.	N. E. by E.	S. E. by E.	42.60	2.5	....	....	" 10.	Clear.	Clear.
5	014	003	29.840	—5.8	28.7	30.8	.028	.129	.161	.81	.80	.90	S. E. by E.	E. by S.	E. by S.	100.10	2.6	....	....	Hoar frost.	Cu. Str. 10.	Cu. Str. 10.
6	29.380	29.320	375	33.0	40.9	37.0	.168	.212	.199	.88	.83	.90	S. by E.	S. by E.	S. W.	136.20	5.3	Inapp.	Inapp.	Cu. Str. 10.	" 10.	" 10.
7	500	529	860	30.1	33.2	23.4	.148	.170	.100	.88	.87	.80	W.	W. by S.	S. W.	264 00	4.0	....	....	" 10.	" 10.	Clear.
8	869	874	899	20.5	26.8	18.6	.091	.105	.093	.84	.75	.90	S. W.	W. S. W.	W. S. W.	67.70	3.0	....	....	" 2.	Clear.	Clear.
9	567	109	068	18.2	38.9	37.7	.088	.195	.209	.90	.80	.90	S. W.	S. W. by S.	S. W.	47.90	2.0	Inapp.	....	Clear.	Cu. Str. 10.	Slight Rain.
10	604	897	30.131	4.6	1.0	—5.0	.038	.034	.022	.73	.71	.63	W. by N.	W. N. W.	N. N. W.	655.10	2.0	....	0.50	Snow.	Clear.	Clear.
11	30.102	914	29.862	—13.3	—4.1	—1.0	.012	.025	.036	.49	.66	.84	W. S W.	W. S. W.	N. E. by E.	117.70	2 0	....	....	Clear.	"	Snow.
12	005	729	974	—1.1	18.0	11.6	.028	.082	.051	.68	.83	.70	N. E. by E.	S. W.	S. W.	146.90	2.3	Inapp.	Inapp.	Cu. Str. 10.	Cu. Str. 4.	Cu. Str. 10.
13	29.842	680	701	15.1	31.9	23.1	.070	.148	.106	.81	.80	.85	S. S. E.	S. by W.	W. N. W.	6.90	4.0	....	Inapp.	" 10.	Slight snow.	" 10.
14	30.047	864	142	—1.1	19.0	1.0	.028	.065	.032	.66	.62	.70	W. S. W.	W. S. W.	W.	106.70	3.3	....	....	Clear.	Clear.	Clear. Zodiacal Light.
15	252	941	846	—8.1	7.0	6.5	.018	.036	.037	.58	.66	.63	N. N. E.	N. E. by E.	N. N. E.	151.40	2.3	....	....	"	C. C. Str. 4.	Clear. Imperfect Lunar Halo.
16	29.424	422	689	20.0	25.8	10.3	.091	.123	.054	.84	.88	.77	E. by S.	S. by E.	W.	223.00	5.0	....	7.90	Snow.	Snow.	Clear.
17	894	799	876	—13.0	12.6	—7.2	.019	.039	.019	.74	.61	.60	W.	W.	W.	67.00	0.5	....	....	Clear.	Clear.	Clear. Aurora Borealis.
18	803	614	874	—19.2	4.0	3.1	.008	.038	.036	.40	.72	.78	S. W.	N. E. by E.	N. E. by E.	115.60	3.0	....	1.00	"	Cu. Str. 10.	Snow.
19	256	340	774	8.9	12.9	6.4	.051	.054	.037	.78	.71	.69	N. E. by E.	W.	W. by N.	539.60	3.3	....	5.10	Snow.	" 10.	Clear. Aurora Borealis.
20	894	650	664	1.0	25.3	28.3	.030	.111	.135	.69	.81	.88	S. by E.	S. by E.	S. W. by S.	123.20	1.6	....	1.10	Cu. Str. 2.	" 10.	Cu Str. 10.
21	801	754	950	26.0	49.5	31.0	.111	.272	.142	.81	.78	.84	S. W. by S.	S. by W.	S. S. W.	103.10	1.3	....	....	Cir. Cum. 4.	Clear.	Clear. Splendid Aurora Borealis.
22	874	462	297	17.2	42.4	30.9	.076	.261	.234	.80	.96	.93	N. E. by E.	S. by E.	S. E.	59.80	7.6	0.295	....	Cu. Str. 10.	Rain.	Cu. Str. 2. Aurora Borealis.
23	075	028	320	35.4	38.4	34.2	.183	.223	.194	.91	.95	.97	S. S. W.	S. S. W.	W. S. W.	111.60	6.6	0.147	....	Clear.	"	Cu. St. 10.
24	676	682	779	16.0	21.1	15.1	.059	.064	.061	.65	.66	.73	W. S. W.	W. S. W.	W. S. W.	397.40	4 0	....	....	Cu. Str. 10.	Cirri 2.	Clear.
25	961	827	971	10.4	25.0	13.2	.052	.094	.059	.71	.68	.74	S. W. by S.	S. W.	W.	91.80	3.3	....	....	" 10.	Clear.	"
26	30.244	30.164	30.090	3.7	22.7	19.0	.030	.079	.087	.59	.65	.84	W. by N.	S. W.	S. S. E.	87.00	4.6	....	....	Clear.	Cu. Cu. 4.	Cu. Str. 10.
27	29.979	29.960	29.901	15.0	46.1	39.0	.072	.262	.201	.82	.84	.86	N. E. by E.	S. E.	S. by W.	26.10	8.0	Inapp.	....	Cu. Str. 10.	Cu. Str. 10.	" 4.
28	30.321	30.300	30.260	20.1	28.4	24.1	.091	.129	.111	.85	.82	.85	N. E.	N. N. E.	N. E. by E.	204.00	6.0	....	....	" 4.	" 4.	" 10.
29	157	030	29.954	21.7	32 0	34.6	.106	.168	.180	.86	.88	.89	N. E. by E.	N. E. by E.	N. E. by E.	127.30	10.0	0.174	....	" 10.	Rain.	" 10.

REPORT FOR THE MONTH OF MARCH, 1860.

Day of Month.	Barometer—corrected and reduced to 32° F. (English inches.)			Temperature of the Air.—F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.			Direction of Wind.			Horizontal Movement in 24 hours. In miles.	OZONE. Mean amount of.	RAIN. Amount of, in inches.	SNOW. Amount of, in inches.	WEATHER, CLOUDS, REMARKS, &c. &c. [A cloudy sky is represented by 10, a cloudless one by 0.]		
	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.					6 a. m.	2 p. m.	10 p. m.
1	29.745	29.583	29.533	32.1	35.0	34.8	.168	.204	.196	.89	1.00	.97	N. E. by E.	N. E. by E.	S. E. by E.	64.00	10.0	0.361	....	Cu. Str. 10.	Slight rain.	Rain.
2	425	516	30.043	32.3	41.3	32.2	.175	.228	.165	.95	.87	.89	W. S. W.	W. by S.	W. N. W.	254.80	7.0	....	....	" 10.	Cu. Str. 6.	Clear.
3	30.102	431	29.087	21.3	32.4	39.2	.090	.156	.201	.80	.82	.84	N. E. by E.	S. E. by E.	S. E.	148.80	1.3	....	....	Clear.	" 9.	Cu. Str. 10.
4	29.300	434	759	31.0	34.0	21.1	.155	.170	.080	.89	.80	.71	S. by W.	S. by W.	W. N. W.	147.50	1.3	....	Inapp.	"	Snow.	Clear.
5	768	500	612	14.1	26.8	10.9	.067	.123	.048	.81	.87	.69	S. W. by S.	W. by S.	N. E. by E.	165.00	3.0	....	0.14	Cu. Str. 10.	"	Cu. Str. 10.
6	856	722	904	8.3	27.0	20.9	.057	.099	.085	.80	.69	.78	S. E.	S. E. by E.	N. E.	121.70	3.0	....	Inapp.	Clear.	Clear.	Clear.
7	824	600	420	19.1	38.2	34 4	.077	.201	.190	.76	.86	.95	N. N. E.	N. E. by E.	E. S. E.	167.70	8.0	Inapp.	1.00	C. Str. 10.	Snow.	Rain.
8	353	256	620	29.4	42.8	36.7	.136	.230	.184	.83	.85	.85	S. E. by E.	S. by W.	W. S. W.	146.60	4.0	....	....	Clear.	Cu. Str. 9.	Cu. Cir. 4.
9	452	462	479	28.0	32.1	21.6	.123	.143	.090	.82	.79	.78	N. W.	N. W.	N. W.	137.10	1.0	....	....	"	" 10.	Cu. Str. 10.
10	348	301	454	16.0	28.4	21.1	.070	.129	.080	.80	.82	.71	E.	W.	W.	654.40	1.0	....	Inapp.	Snow.	" 10.	Cu. Str. 10.
11	547	440	601	20.0	32.0	28.2	.090	.143	.128	.78	.79	.83	W.	W.	W.	451.80	1.0	....	....	Clear.	Clear.	Clear.
12	689	625	670	18.9	26.9	27.0	.087	.112	.129	.85	.76	.88	N. E. by E.	N. E. by E.	N. E. by E.	211.80	0.5	....	Inapp.	Cu. Str. 10.	Cu. Str. 10.	Clear. Faint Aurora Borealis.
13	976	850	914	11.4	35.9	22.7	.056	.170	.079	.72	.80	.65	S. W. by S.	S. W. by S.	S. W. by W.	172.20	0.5	....	....	Clear.	Clear.	Clear. Aurora Borealis.
14	971	797	790	13.4	41.0	31.0	.052	.190	.142	.72	.74	.84	S. W. by W.	S. W.	S. W. by S.	9.70	1.0	....	....	"	"	Clear. Aurora Borealis.
15	30.017	902	944	24.4	49.6	36.1	.105	.290	.177	.80	.82	.85	S. W. by S.	S. W. by S.	S. by E.	2.20	1.6	....	....	"	"	Clear.
16	130	747	942	29.0	57.9	46.0	.129	.343	.241	.82	.72	.84	S. by W.	S. by W.	S.	0.80	1.5	....	....	"	"	Clear. Aurora Borealis.
17	050	994	949	31.1	64.1	39.4	.155	.362	.190	.80	.87	.80	S. by E.	S. by E.	S. E.	1.00	1.3	....	....	"	"	Clear. Aurora Bor. Solar Halo.
18	159	939	932	30.1	62.0	37.6	.148	.334	.178	.89	.86	.83	E.	E. by N.	E. by S.	0.00	3.3	....	....	"	"	Clear. Aurora Borealis.
19	29.920	492	479	30.0	60.0	49.0	.148	.317	.223	.89	.62	.64	E. by N.	S. E. by E.	S. S. E.	0.00	3.6	....	....	"	"	Clear. Aurora Borealis.
20	854	042	369	39.0	39.0	37.0	.201	.223	.199	.86	.95	.90	S. S. E.	W. S. W.	S. S. W.	1.00	4 3	0.017	....	Cu. Str. 10.	Rain.	Cu. Str. 9.
21	479	527	624	20.0	24.0	17.0	.106	.094	.068	.86	.73	.75	W. by S.	W.	W. by N.	133.90	2.0	....	0.61	" 10.	Snow.	Cu. Str. 10.
22	327	318	660	10.1	20.9	17.2	.048	.096	.078	.78	.85	.83	W. by N.	W.	S. S. W.	306.30	2.3	....	1.38	Snow.	Cu. Str. 10.	Clear.
23	541	324	329	6.4	34.0	23.6	.049	.144	.100	.89	.75	.79	S. W.	S. W.	S. S. W.	65.90	1.0	....	....	Clear.	Clear.	Clear. Aurora Borealis.
24	125	080	210	21.1	52.9	26.1	.080	.131	.117	.71	.70	.76	S. S. W.	W. by S.	W. S. W.	220.80	2.3	....	Inapp.	Cu. Str. 4.	C. C. Str. 8	Cu. Str. 10.
25	214	234	500	19.6	34.0	31.6	.081	.155	.149	.77	.79	.84	W. S. W.	S. W. by S.	W. by N.	164.90	3.3	....	1.10	Snow.	Snow.	Cu. Str. 10.
26	679	532	829	23.6	36.2	26.3	.100	.149	.117	.79	.71	.81	W.	W. S. W.	W. S. W.	178.10	3.3	....	....	Cu. Str. 10.	Cu. Str. 4.	Cu. Str. 10.
27	797	547	610	12.1	40.0	33.0	.060	.182	.156	.80	.73	.85	S. W. by S.	S. W. by S.	S. W. by S.	90.80	1.0	....	....	Clear.	Clear.	Clear.
28	381	350	471	34.6	36.1	26.9	.149	.170	.115	.74	.80	.83	S.	W.	S. W.	194.00	1.0	....	....	"	Cu. Str. 4.	C. C. Str. 9.
29	501	400	514	17.0	33.7	27.6	.078	.162	.123	.85	.84	.82	S. S. W.	S. W.	S.	21.60	1.3	....	....	Cu. Str. 10.	" 10.	Clear.
30	674	183	184	24.2	52.6	40.0	.100	.282	.221	.79	.73	.90	S. by W.	S. S. E.	S. S. W.	2.10	4.0	....	....	Clear.	Clear.	Clear.
31	162	28.714	008	33.6	61.1	45.0	.182	.383	.251	.91	.71	.84	S. E.	S. W.	W. S. W.	152.00	2.0	....	....	C. C. Str. 4.	"	Clear.

REMARKS FOR FEBRUARY, 1859.

Barometer .... Highest, the 3rd day, 30·470 inches.
Lowest, the 23rd day, 29.028 "
Monthly Mean, 29.813 "
" Range, 1.442 "

Thermometer... Highest, the 21st day, 49°5.
Lowest, the 1st day, —25°0.
Monthly Mean, 15°70.
Monthly Range, 74°5.

Greatest intensity of the Sun's rays, 68°1.
Lowest point of Terrestrial radiation, —27°4.
Mean of Humidity, .751.
Rain fell on 7 days, amounting to 0.616 inches; it was raining 29 hours and 55 minutes.

Snow fell on 8 days, amounting to 15.60 inches; it was snowing 48 hours and 25 minutes.
Most prevalent wind, the N. E. by E.
Least prevalent wind, the S.
Most windy day, the 10th day; mean miles per hour, 28.30.
Least windy day, the 2nd day; mean miles per hour, 0.18.
Aurora Borealis visible on 4 nights.
Lunar Haloes visible on 2 nights.
The Electrical state of the Atmosphere has indicated moderate intensity.
Zodiacal Light visible. Venus prevents an early or well defined view.

REMARKS FOR MARCH, 1860.

Barometer. ...... Highest, the 18th day, 30.159 inches.
Lowest, the 31st day, 28.714 "
Monthly Mean, 29.562 "
Monthly Range, 1.445 "

Thermometer. Highest, the 31st day, 61°1.
Lowest, the 6th day, 8°3.
Monthly Mean, 30°52.
Monthly Range, 52°8.

Greatest intensity of the Sun's rays, 83°0.
Lowest point of terrestrial radiation, 8°0.
Mean of humidity, .813.
Rain fell on 3 days, amounting to 0.378 inches; it was raining 23 hours 10 minutes.

Snow fell on 10 days, amounting to 4.10 inches; it was snowing 43 hours 1 minute.
Most prevalent wind, the W.
Least prevalent wind, the E.
Most windy day, the 10th day; mean miles per hour, 27.26.
Least windy day, the 10th day; calm.
Crows first seen on the 1st day.
Song Sparrow (*Frangilla melodia*) first heard on 10th day.
Distant Lightning on the 5th day.
Wild Geese (*Anser Canadensis*) first seen on 27th day.
Aurora Borealis visible on 8 nights.
Solar Halo visible on 1 day.
The Electrical state of the atmosphere has indicated rather feeble intensity.

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ARTICLE. XIII.—*New Species of Fossils from the Lower Silurian Rocks of Canada.* BY E. BILLINGS.

(*From the Report of the Geological Survey for* 1860.)

STRAPAROLLUS CIRCE. N. S.

Fig. 1.

Fig. 2.

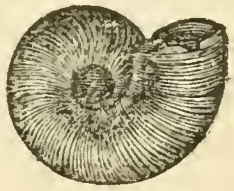

Fig. 3.

Fig. 1.—*Straparollus Circe.* Front view.
2.—Vertical view of the spire.
3.—View of the umbilicus.

Description.—Depressed conical, height a little more than half the width, apical angle about 125°; apex rounded, not acute; whorls four or five, with a nearly circular section; umbilicus deep, conical, extending quite to the apex, about one third the width of the shell. Aperture nearly circular, the height slightly exceeding the width, scarcely indented by the preceding whorl Surface nearly smooth. Suture distinct.

Width of the only specimen examined eight lines; height five lines; width of aperture three lines.

This species closely resembles the original *Straparollus Dionysii* upon which Montfort established the genus. It also approaches *Euomphalus cyclostomus*, (Hall). Geology of Iowa Pl. VI. fig., 6 (Hamilton Group Iowa).

Locality and Formation.—Pauquettes Rapids, Ottawa River, Black River, and Birdseye. (very rare).

Collector.—Sir W. E. Logan.

STRAPAROLLUS EURYDICE. N. s.

Fig. 4.

Fig. 5.

Fig. 4.—*Straparollus Eurydice.* Front view.
5.—Side view.

Description.—Conical, apical angle about 60°, rounded not acute; height and width about equal; whorls five, with a nearly circular section, uniformly ventricose; suture distinct; umbilicus small, deep, one sixth the width of the base of the shell; the body whorl obtusely carinated close to the edge of the umbilicus; the aperture nearly circular, its height slightly exceeding the width. Surface with obscure lines of growth, which cross the whorl a little obliquely from the suture downwards and backwards; a few wide shallow undulations parallel with the lines of growth.

Height seven lines; width the same; width of aperture three lines, height three and a half.

Locality and Formation.—Pauquettes Rapids, River Ottawa, Black River, and Birdseye.

Collector.—Sir W. E. Logan.

STRAPAROLLUS ASPEROSTRIATUS. N. s.

Description.—Shell small, depressed-conical; apical angle between 80° and 90°; whorls about three with a nearly circular section, regularly ventricose above; obscurely carinated along the middle on the underside, suture distinct, umbilicus about one fourth the width of the shell, penetrating to the apex; aperture circular. Surface with strong sharply elevated lines of growth,

which on crossing the whorl are deflected gently backwards until on approaching the base of the body whorl, they turn a little forward and pass vertically into the umbilicus. There are six striæ in the width of one line. Width of only specimen seen five lines, height four lines; width of aperture two and a half lines.

This species differs from *S. Circe* in being much smaller, and in having the surface so strongly striated as to present a peculiarly rough file-like appearance; only one specimen has been collected, but as it exhibits the aspect of a mature shell, I am inclined to think the species is small.

Locality and Formation.—Pauquettes Rapids, Ottawa River, Black River, and Birdseye, (apparently rare).

Collector.—Sir W. E. Logan.

The following species of *Pleurotomaria* have been usually referred to *P. lenticularis*, (Sowerby) but they all appear to be distinct from that species.

PLEUROTOMARIA PROGNE. N. S.

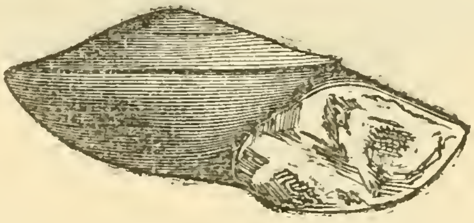

Fig. 6.

Fig. 6.—*Pleurotomaria Progne.*

Decription.—Lenticular; about one inch and a half in width; spire depressed conical, apical angle about 140°, seldom more but often a little less; surface of spire presenting an uniform nearly flat, smooth slope from the apex to the margin, the sutures in perfect specimens being scarcely distinguishable although in casts of the interior they are somewhat strong and deep. The margin is narrowly rounded and does not exhibit the acute edge possessed by such species as *P. qualteriatus*. On the under side the whorls are uniformly depressed convex and the base, or all that portion of the shell which lies below the margin, is usually nearly double the bulk of the spire. When perfect the umbilicus is completely closed, but in the casts of the interior, there is a small perforation. The aperture is transversely sub-oval, scarcely sub-rhomboidal

and in perfect specimens the width must be nearly twice the height. There are about four whorls. The surface appears to be nearly smooth, but as the only specimens with the shell preserved, that I have seen are silicified, they do not exhibit it perfectly.

This species differs from all those described by Hall in the Palæontology of New York in having the umbilicus closed and from the *P. lenticularis* and *P. qualteriatus* of the European authors, not only in the same respect, but also in having the margin rounded instead of acute.

Locality and Formation.—City of Ottawa; near Montreal; Belleville; Trenton, and numerous other localities in Trenton Limestone; good specimens extremely rare.

Collectors.—Sir W. E. L.; A.M.; J. R.; E. B.

PLEUROTOMARIA AMERICANA.

P. lenticularis ?—Hall, *Pal. N. Y.*, p. 172.
Not *P. lenticularis.*—Of European Authors.

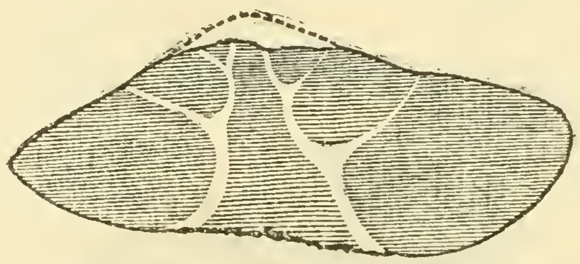

Fig. 7.

Fig. 7.—*Pleurotomaria Americana.* A section through the umbilicus. General form same as *P. Progne*, (see fig. 6) from which species it only differs in having an open umbilicus.

Description.—Lenticular, one or two inches wide; whorls four or five, nearly flat above, elevated into a depressed conical spire with a nearly smooth continuous slope from the apex to the margin; the latter obtusely rounded. On the under side the whorls are moderately convex, forming a depressed conical base, the bulk of which is always somewhat greater than that of the spire. The umbilicus penetrates to the apex, and is in general somewhat less than one third of the whole width of the shell. The aperture is transversely sub-rhomboidal, the width about one third greater than the height.

The surface is rarely preserved, but from such fragments of the shell as I have seen it must be nearly smooth or at least very finely striated.

This is the most common species of *Pleurotomaria* in the Trenton Limestone, and is I have no doubt the same as that figured by Prof. Hall in the work above cited, but surely it cannot be the European species *P. lenticularis* to which it has been referred. That species has a sharp edged margin. There are several European species under the name *P. lenticularis*, but it is the Silurian form to which I refer.

P. rotuloides.—(Hall) has not the smooth spire, and concealed suture of *P. Americana*, and there is no other in the Palæontology of New York, to which this species can be compared. It may be that *P. Progne* and *P. Americana* should be classified as one species, but at present I think the great difference in the umbilicus is sufficient to separate them.

Locality and Formation.—Trenton Limestone at Ottawa, Montreal, Beauport, Trenton, Belleville, and St. Joseph's Island, Lake Huron. Good specimens exceedingly rare.

Collectors.—Sir W. E. L.; A.M.; J. R.; E. B.; R. B.

Pleurotomaria Helena. N. s.

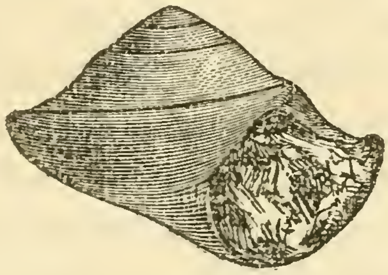

Fig. 8.

Fig. 8.—*Pleurotomaria Helena.*

Description.—Sub-lenticular, with an elevated narrowly rounded margin ; spire depressed conical ; apical angle varying from 110° to 125°, apex rounded not acute ; whorls about four, the last one rather strongly concave on the upper side, the others only slightly so. On the under side of the shell the whorls are moderately convex, and the umbilicus closed. The aperture is a little wider than high, the upper part of the inner lip slightly indented by the body whorl, the lower half somewhat vertical, but rounded, the lower part of the outer lip from the umbilicus to the margin of the whorl gently convex, the portion above the margin concave. In most specimens the suture is enamelled, the shell appearing to be continuous from the apex to the margin, but in some, especially

those which are a little worn, it can be more or less distinctly seen; the last whorl usually drops a little below the margin of the next preceding, but even in such instances the suture is not very distinct. In the specimens from shaly rocks no surface markings are visible, but in those from the sandstone of Anticosti, the striæ are distinctly visible curving backwards from the suture to the margin. They are very fine in general, but there are occasionally a few coarse ones at distances of half a line or thereabouts from each other. Width from ten to fifteen lines; height a little variable; usually about three fourths of the width.

This species is evidently allied to *P. calcifera*, but differs therefrom in having no umbilicus.

Variety.—Associated with the specimens upon which the above description is founded are several others which have the last whorl on the underside obtusely angulated at about two thirds the width from the outside, this angulation forming the edge of a shallow concave umbilicus, about one third of the whole width of the shell but which does not appear to penetrate the spire more than half the depth of the last whorl.

One of these specimens is nearly two inches wide, with the strongly elevated margin forming a spiral ridge quite to the apex, this character giving to the spire a more distinctly turretted aspect than is exhibited by the specimen above figured. It may be that these should constitute distinct species, but the fact of their having been found associated together both at Lake Huron and Anticosti induces me to regard them as only varieties.

Locality and Formation.—Cape Smith, Lake Huron; Hudson River Group; and also in the same formation at Anticosti.

Collectors.—J. Richardson and R. Bell.

OPHILETA OTTAWAENSIS. N. S.

Description.—About one inch wide; whorls four or five; an elevated sharp margin all round; spire concave more or less depressed below the plane of the margin; underside of whorls regularly ventricose; umbilicus wide, shallow, concave, exposing all the whorls, occupying all the space within the outer whorl. Surface not observed.

Width of largest specimen seen fourteen lines; width of last whorl at the aperture five lines; depth of same four lines; depth of concavity of spire in the centre nearly one line; of umbilicus rather more than one line. The depth of the concavity of the

spire varies greatly. A small specimen eight lines wide consisting of three whorls has the spire full two lines depressed below the margin the lower side being nearly flat.

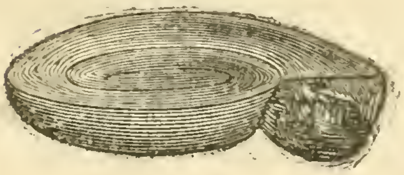

Fig. 9.

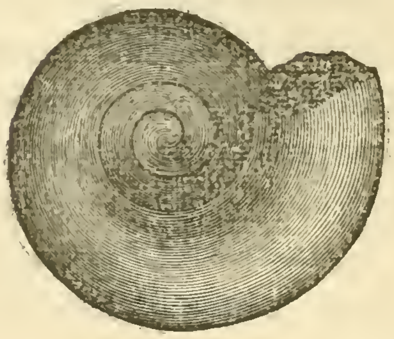

Fig. 10.

Fig 9.—*Ophileta Ottawaensis.* Front view partly shewing the depressed spire.

10.—View of the base. The specimen figured has the whorl more slender than they are in the majority of the individuals.

In the geology of Russia plate 23 Figs. 2*a* 2*b* De Verneuil and De Keyserling have figured a species almost identical with this, but they regard it as only a variety of *Pleurotomaria qualteriatus.* It appears to me however to be a distinct species. We have in the Trenton Limestone a number of species of *Pleurotomaria* and in some localities the individuals (although rarely perfect) are not uncommon. Yet I have never seen any specimens that could be considered as intermediate forms between the one here described and those which belong to the group of *P. qualteriatus.*

This species differs from *O. compacta* Salter principally in having the umbilicus concave instead of flat.

Locality and Formation.—City of Ottawa, Trenton; not common.

Collector.—E. B.

BELLEROPHON ARGO. (N. S.)

Description.—Lenticular; from half an inch to an inch and a-half in diameter, (usually about one inch); the dorsum with a rounded edge and the sides rather strongly and uniformly convex. Whorls three or four, each concealing about two-thirds of the one next preceding it. Umbilicus small, exposing all the whorls in a series of rectangular steps. Aperture not expanded, triangular, indented on the ventral side to about one-third its height by the dorsum of the penultimate whorl, the two sides gently convex uniting at the dorsal angle at about 80° or 90°. Surface apparently not striated but often exhibiting some rough transverse undulations.

Diameter of a specimen of the ordinary size fifteen lines; thickness in the centre seven lines; width of that portion of the umbilicus which is formed of the last whorl three lines; of the portion included in the penultimate whorl one line and one fourth; width of aperture at the base eight lines; height about the same. A small specimen nine lines in diameter is four lines and a-half in thickness at the centre; umbilicus two lines wide; aperture five lines wide at base and the same in height.

Locality and Formation.—This species occurs at Pauquettes Rapids in the Black River and Birdseye Limestone and also at Lake St. John at the same level.

Collectors.—Sir W. E. Logan. T. Richardson.

BELLEROPHON DISCULUS. N. S.

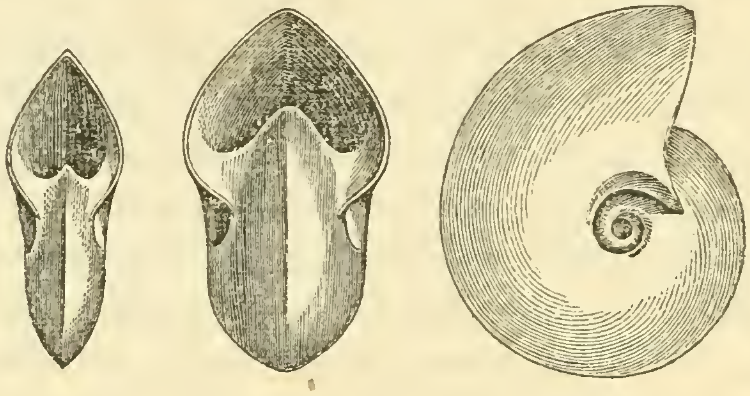

Fig. 11. Fig. 12. Fig. 13.

Fig. 11.—*Bellerophon disculus.* Front view.
12.—*Bellerophon Argo.* Front view.
13.—Side view of the latter.

Description.—Lenticular; compressed; greatest thickness at the umbilicus about one fourth the diameter; the dorsum acutely? angular; the sides gently convex next to the umbilicus, becoming somewhat flat or very slightly concave towards the circumference. Whorls two or three each concealing rather more than half of the one next preceding it. Umbilicus small exposing all the whorls in a series of rectangular steps. Aperture triangular, not expanded, indented on the ventral side to about one third its height by the preceding whorl; the two sides gently convex uniting at the dorsal angle at an angle of about 50°. Surface apparently nearly smooth.

Diameter of the only specimen examined one inch; thickness at the umbilicus three lines; width of umbilicus four lines.

This species agrees exactly with *B. Argo* in all respects except in being only one half the thickness and in having the umbilicus a little larger. It is also closely allied to *B. acutus* Sowerby but that species is, according to Sowerby and McCoy only six or seven lines in diameter and nearly half as much in thickness.

Locality and Formation.—Blue Point Lake St. John's. Black River and Birdseye Limestone.

Collector.—J. Richardson.

BELLEROPHON CHARON. N. s.

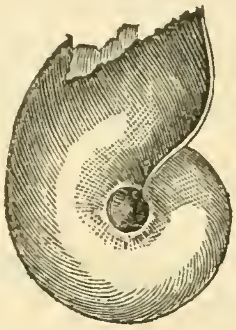

Fig. 14.

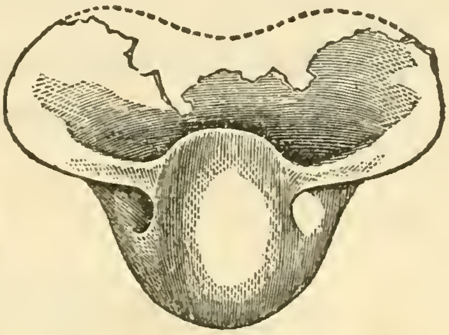

Fig. 15.

Fig. 14.—*Bellerophon Charon.* Side view.
15.—Front view.

Description.—Sub-globular with a widely expanded aperture; diameter about an inch. Whorls about three each concealing half of the one next preceding it. Dorsum broadly rounded; a scarcely perceptible angulation along the median line, on each side of which, especially towards the aperture the shell is in some specimens very slightly flattened. The umbilicus is deep, penetrating to the centre, exposing all the whorls, the inner ones only obscurely seen, owing to their being imbedded in those preceding them. The sides encircling the umbilicus narrowly rounded, not angular. The aperture is very much expanded transversely, widely auriculated on each side, the width being about three times the height; the ventral side indented by half the thickness of the preceding whorl and the dorsal border apparently with a wide though not very deep emargination. The surface apparently nearly smooth or only very finely striated.

Diameter of a nearly perfect specimen, measured from the middle of the dorsal lip through the aperture to the opposite side, one inch; width of aperture at base sixteen lines; height of aperture, five lines; width of last whorl at the entrance of the aperture, five lines; diameter of umbilicus, three lines. A cross section of the

whorl would be elongate sub-oval (or owing to the indentation caused by the preceding whorl, reniform) in the proportion of about two and a half to five.

Allied to *B. rotundatus*, (Hall) but that species according to the figures has the umbilicus full half the whole diameter, and the whorl angulated at the sides. In this species the umbilicus is about one fourth the whole diameter, and the whorls rounded at the sides. The aperture also in *B. Charon* must be proportionally much wider.

There appears to be some variation in the proportions of different individuals of this species, but as most of the specimens are mere fragments, the amount cannot be determined at present.

Locality and Formation.—Pauquettes Rapids, Black River, and Birdseye Limestone.

Collector.—Sir W. E. Logan.

Genus PILOCERAS (Salter.)

PILOCERAS (Salter) *Quart. Jour. Geo. Soc.* vol. 15, p. 376. 1859.

This genus consists of short, thick, curved Orthoceratites, with a very large siphuncle, the smaller extremity of which is, for a short distance, filled with a solid secretion so organised as to exhibit the appearance of several hollow cones inserted one within another.

The specimens upon which Mr. Salter founded the genus were imperfect and did not exhibit the true septa, but there are now in the collection of the Geological Survey of Canada two fragments of different individuals of a species of this genus, with several of the septa well preserved, so that there can be no doubt of their existence. The discovery of these fossils, and also of *Maclurea Atlantica* in Canada, furnish an interesting additional proof of the value of organic remains in establishing the equivalency of widely separated deposits of rock. When Sir R. I. Murchison, in 1857, announced that certain beds of limestone in Scotland were of the age of the Calciferous Sandrock and Chazy formations of Canada and New York, the only evidence consisted of a few imperfect fossils, among which were an *Ophileta*, considered by Mr. Salter to be either identical with or closely allied to the Canadian *O. compacta*, together with a *Maclurea* of a new species and several Orthocerites, resembling in aspect those asso-

ciated with the genera *Ophileta* and *Maclurea* in this country. Their *Maclurea Peachii* has a long spiral operculum, very unlike anything then known on this side of the Atlantic, and it was not suspected that the genus *Piloceras* would ever be found here at all. But we have now not only a species of *Piloceras* (from the Calciferous Sandrock) but also *Maclurea Atlantica* (from the Chazy) which latter species has an operculum almost identical with that of *O. Peachii*. When it is considered that evidence of this kind as it accumulates increases in its demonstrative power in a much higher ratio than do the mere number of the species (or the facts which constitute the data) the correctness of the view that the Scottish and Canadian rocks above referred to are of the same age, cannot fail to be perceived.

PILOCERAS CANADENSE. N. S.

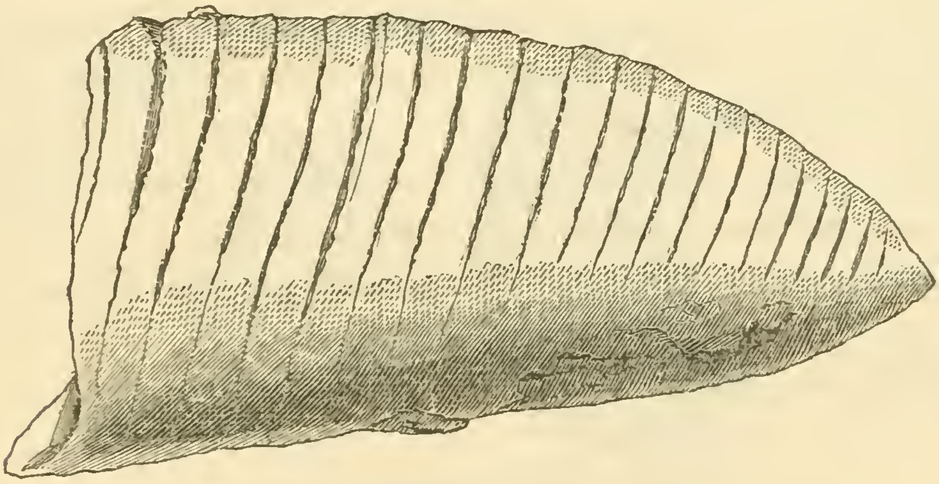

Fig. 16.

Fig. 16.—Side view of the solid portion of the siphuncle shewing distance of the septa.

Description.—Of this species we have, besides several detached siphuncles, two fragments, each exhibiting some of the septa. The form, as nearly as it can be determined is that of a short thick curved Orthoceratite. The length of the largest specimen appears to have been about ten inches, and the diameter at the aperture four or five inches. The transverse section is oval, the narrowest side being that of the concave curvature. The siphuncle of one specimen is, at two inches and three-fourths from the apex, seventeen lines in diameter in the dorso-ventral direction, and fourteen lines in the transverse direction. On the surface of this specimen there are, on an average, six septal rings in the length of one inch. Judging from the appearance of another spe-

cimen, the position of this siphuncle would be close to the ventral side of the shell. Another siphuncle about the same size shows seven septal rings to the inch. In a third, consisting of a portion of the larger extremity of an individual which, when perfect, must have been at least nine inches in length, there are six septa partly preserved apparently those next the aperture. They are distant from each other about five lines, the whole being comprised within a length of thirty lines. The shell where these septa are situated is at least four inches in diameter in the transverse direction, and the siphuncle about two inches. The edges of the septa, in crossing the ventral or concave side, make at the surface a short curve towards the apex, but on the siphuncle the septal ridges cross from the dorsal to the ventral side obliquely, so that on the ventral side they are somewhat nearer the aperture than they are on the dorsal side.

The above are all the details of this species of any importance furnished by our specimens. On comparison with Salter's *P. invaginatum*, it will be seen that the septal rings do not cross the siphuncle in the same direction as they do in ours, and further, that that species is more broadly curved.

Locality and Formation.—Mingan Islands, Calciferous Sandrock.

Collectors.—Sir W. E. Logan. J. Richardson.

CYRTOCERAS EXIGUUM. N. s.

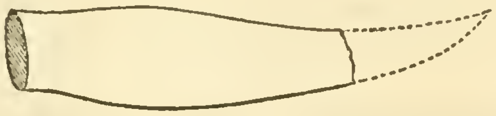

Fig 17.

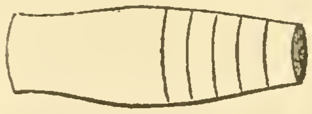

Fig. 18.

Fig. 17.—*Cyrtoceras exiguum.* Outline of a specimen. The dotted lines represents the supposed outline of the smaller extremity.

18.—A specimen shewing the depth of the chamber of habitation and five of the air chambers.

Description.—Small, slender, slightly curved; section circular. One of the specimens examined is three lines in diameter at the aperture and apparently a little less at one line and a half above. The shell then expands to a diameter of four lines at the distance of five lines from the aperture. It then tapers to two lines at a

length of thirteen lines; thence to the apex unknown, but probably terminated at a length of eighteen or twenty lines. One side of the fragment is nearly straight. No septa or siphuncle observed in this specimen, but the form alone is sufficient to distinguish the species from any other known in the Lower Silurian of this country. Associated with the one above described was found another fragment ten lines and a half in length. Width at aperture three lines; diameter at five lines from aperture four lines; length of chamber of habitation five lines and a half. Next to the chamber of habitation five of the septa are preserved and they occupy a length of exactly five lines; the siphuncle not visible.

Locality and Formation.—Near L'Orignal, Trenton limestone.

Collector.—R. Bell.

PRAGMOCERAS PRÆMATURUM. N. S.

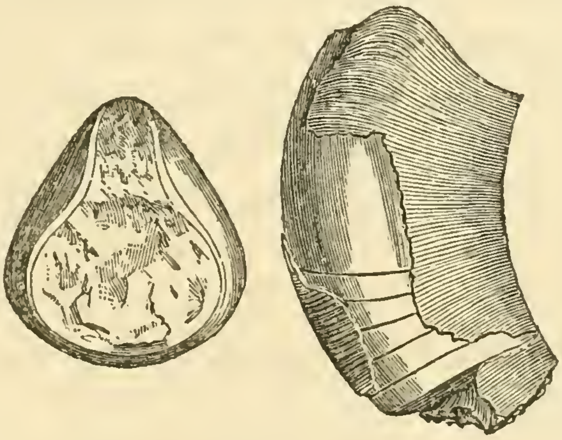

Fig. 19. Fig. 20.

Fig. 19.—*Phragmoceras præmaturum.* Aperture of a specimen.
20.—Side view of a different individual.

Description.—Ventral aspect with the convex curvature; dorsal aspect concave; section oval narrowly rounded on the ventral aspect; depressed convex on the sides and broadly rounded on the dorsum. In the first inch and a half of the length the ventral side forms a curve of which the radius is about one inch; the remainder of the curve to the apex unknown. The aperture is broadly rounded on the dorsal side; at about one third the dorso-ventral diameter it begins to contract; at two thirds its diameter its transverse width is about half its greatest width; thence to the ventral margin the sides are sub-parallel, gradually approaching each other; the ventral margin narrowly rounded. On a side view the dorsal two thirds of the aperture is obliquely truncated.

towards the apex while the ventral third slopes so as to form an obtusely rounded right angle with the dorsal two thirds. The aperture is thus obscurely trilobed, the ventral lobe being the smallest and forming a deep narrow sinus in the ventral margin. At the aperture the greatest transverse width is six lines in the specimen on which the species is founded; the dorso-ventral diameter eight lines. At seven lines (from the most prominent point of the aperture on the side) we find the greatest transverse diameter which is here seven lines and a half and the dorso-ventral diameter nine lines. At the length of one inch and a fourth the dorso-ventral diameter is reduced to between five and six lines. The remainder of the specimen is not preserved. The depth of the chamber of habitation is ten lines. The first five septa occupy six lines of the ventral margin, but at the middle of the lateral aspect four lines and a half. Siphuncle about one line in diameter and apparently in contact with the shell along the median line of the ventral side. The surface of the shell is covered with fine striæ or rather small smooth continuous wrinkles which encircle the tube following the curves of the aperture. These wrinkles vary in size, but in general there are five or six in the width of one line.

The majority of the species of this genus have the siphuncle on the inside or close to the shell on the side of the concave curvature. M. Barrande, however, has one species *P. perversum* in which it lies close to the outer curve.* The aperture is not so strongly trilobed as it is in Upper Silurian and Devonian species. I believe this is the only *Phragmoceras* known in the Lower Silurian Rocks.

Locality and Formation.—The specimen figured was found on Le Cloché Island, Lake Huron, in the Black River Limestone. Two other fragments have been collected, one at La Petite Chaudière Rapids and the other at Pauquettes Rapids, Ottawa River, in the same formation

Collectors.—Sir W. E. Logan, R. Bell, E. Billings.

ORTHOCERAS TENER. N. s.

Description.—Small, section sub-oval; broadly rounded on the dorsal and very gently convex on the ventral aspect; sides nar-

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* See translation of Barrande's note on the Silurian Cephalopoda of Bohemia, Jour. Geo. Soc. Vol. X. Translations p. 21.

rowly rounded. Siphuncle very small, close to the ventral margin slightly dilated between the septa; of these latter there are six in three lines where the transverse diameter of the shell is five lines.

The dimensions of the best preserved specimen that I have seen are as follows. Length of specimen twenty-two lines; transverse diameter of aperture seven lines; dorso-ventral diameter of aperture five lines; depth of chamber of habitation, twelve lines; transverse diameter at smaller extremity of specimen four lines nearly; dorso-ventral diameter three lines nearly. In the length of twenty-two lines measuring from the aperture this specimen tapers three lines in the tranverse diameter and one line in the dorso-ventral diameters. The width of the siphuncle between the septa is about three-fourths of a line; its passage through the septa is a small circular aperture scarcely one third of a line in diameter. At the smaller end of this specimen the greatest transverse width is about one fourth the dorso-ventral diameter from the ventral margin. The aperture is more nearly a regular oval. The siphuncle is in the middle of the ventral aspect. The shell is gently curved towards the dorsal side.

This species is related to both *O. xiphias* and *O. hastatum*, (Report for 1856, p. 318 and 333) but the proportions are very different. In *O. xiphias* the two diameters of the aperture are to each other as 7 to 3, but in *O. tener* they are as 7 to 5. *O. hastatum* tapers at the rate of about 4 lines to the inch, while in *O. tener* the rate is scarcely two lines.

Locality and Formation.—Black River limestone. Pauquettes Rapids.

Collectors.—Sir W. E. Logan, E. Billings.

Orthoceras pertinax. N. s.

Description.—The specimen on which this species is founded is two inches and five lines in length; nine lines in diameter at the larger and seven lines at the smaller extremity; section circular; septa distant three lines at the large end and two lines and a-half at the small end. The siphuncle is moniliform its centre distant two lines from the margin where the diameter is seven lines; the expansions are sub-globular and about two lines or a little more in their greatest diameter. The septa have a convexity equal to about half their distance from each other and they cross the tube obliquely so that their edges at the surface on the

dorsal side are full half the distance between them nearer the aperture than they are on the ventral side.

The probable length of this *Orthoceras* judging from several imperfect specimens which I believe to belong to the species is from one foot and a half to two feet.

The surface exhibits some indistinct flat longitudinal ridges, each about one third of a line wide and half a line distant from each other.

Locality and Formation.—Pauquettes Rapids, Ottawa River, Black River limestone.

Collector.—Sir W. E. Logan.

ORTHOCERAS RAPAX. N. S.

Description.—Large, section circular, septa distant a little less than one fourth of an inch where the diameter is between five and six inches. Siphuncle large, marginal very nearly in contact with the shell on the ventral side. The rate of tapering appears to be about one inch and a half to the foot. The depth of the chamber of habitation is about one half greater than the width of the aperture.

Of this species we have portions of two individuals. One is a fragment of the oral extremity entirely deprived of the shell, and exhibiting a good cast of the interior of the chamber of habitation. The following are the dimensions. Length fourteen inches; diameter at aperture six and a half inches; at fourteen inches from aperture, four and three fourths inches; diameter of siphuncle one inch and three fourths at the broken or smaller end of the specimen; the first twenty one septa occupy a length of four inches and seven eighths.

The second specimen is fifteen inches and a half in length, and tapers from six inches to four as nearly as can be determined. In the first five inches of the smaller extremity there are twenty septa; in the next inch five; in the next inch and a half twelve, and in the remainder from four to seven in the inch.

The distance of the septa is thus variable in the same specimen, but judging from the general appearance of the two examined, my present impression is that the average distance must be from two and a half lines to three lines, or a little less than one fourth of an inch at a diameter of from four to six inches. The proportional distance of the septa to the diameter of the shell therefore would be about as twenty to one.

This species clearly belongs to the same group with those which Professor Hall has figured under the name of *Endoceras proteiforme*, in the 1st Vol. of the Palæontology of New York. But on measuring the figures in that work it will be seen that the proportional distance of the septa to the diameter of the shell in that species is between four and eight to one or six to one on an average while in this species it is twenty to one.

Locality and Formation.—The specimens were procured at Kingston in the Black River Limestone.

Collector.—The specimens were collected by Col. Gordon, R.A. and by him presented to the Geological Survey.

ARTICLE XIV.—*Notices of the Life of the late Professor George Wilson of Edinburgh.*

The University of Edinburgh has lately suffered severely by the death of several of its most distinguished teachers. The department of science has been specially unfortunate. Since the death of the venerable Jamieson, Professor Forbes, whose fine genius and extensive erudition gave promise of an illustrious life, has been laid in the sepulchre of his fathers; and ere yet his country, and we may say the world of science, had ceased to mourn for this most gifted of her children, another equally honorable and beloved has been laid in the dust. The name of Professor George Wilson, whose recent appointment as Regius Director of the Industrial Museum of Scotland and to the professorship of Technology in the University of Edinburgh was hailed with so much satisfaction by all who had any acquaintance either with his personal character or numerous contributions to literature and science, will we are sure be held in lasting and affectionate remembrance.

The most complete notice of his life and works which we have yet seen is that contained in the February number of the North British Review. The article is preceded by a list of no less than sixty eight of his writings. They comprise original papers on chemistry, biographical sketches of men eminent in science, several contributions to popular and scientific literature with four poems published in Blackwood's Magazine. The ability, research,

and true genius which all those writings display, will ever give the name of George Wilson a high place among the illustrious dead We are sure it will be grateful to those of our readers who may not have access to other sources of information to be ut in possession of the following particulars of his history.

Dr. Wilson was born in Edinburgh, on 21st February 1818; and was thus, at his death, in the forty-first year of his age. "His parents were highly respectable, though not in such an elevated station as to diminish the credit due to his own exertions in attaining the position which he ultimately reached; but it deserves to be noticed, that he may be included in the number of distinguished men who have been in a great degree indebted for the development of their talents to the maternal character and influence."

His father, Mr. Archibald Wilson, was a wine merchant in Edinburgh, and died about sixteen years ago. His mother, Janet Aitken, who is still living, was the youngest daughter of a land-surveyor in Greenock. She was a lady of great intelligence and piety, and she devoted much attention to the education of her children. There were eleven of the family; but of these only three now remain,—a son, Dr. Daniel Wilson, the well-known author of "The Prehistoric Annals of Scotland," at present Professor of English Literature and History in the University of Toronto,—and two daughters. From his childhood, George was distinguished by many noble qualities—great truthfulness, self-sacrifice, delicate sense of honour, and generous feelings. Studious, and with a marked love for books, he gave early promise of great mental ability.

In 1822 he commenced his studies in a private school, and in 1828 he entered as a pupil of the High School, under Mr. Benjamin Mackay, an able classical teacher. He was always among the first five in the class, and was remarkable for his *general knowledge*—a quality which was exhibited during life, and which seemed afterwards to fit him specially for the situation he occupied in the University. So warm were his affections, and such his power of attracting others, that from his boyhood onwards no one was more generally beloved. While at school, in 1828-29, he and his brothers formed among their companions a "Juvenile Society for the Advancement of Knowledge." They met once a week in his father's house, when papers were read on natural

history, mechanics, astronomy, etc. Minutes of their proceedings were kept by his brother Daniel. His mother presided over the youthful assembly, and usually wound up the evening by giving a verse from Proverbs.

Wilson remained at the High School until he was fifteen. On leaving it he selected Medicine as his object of study, and commenced by becoming an apprentice in the laboratory of the Royal Infirmary, where he remained for four years. The suffering and distress which he witnessed during this period, made an indelible impression on his very sensitive nature, and had a saddening effect on his mind. Many are the stories which might be told illustrative of his sympathy with the patients, and his eager desire to relieve them.

He entered the University of Edinburgh in 1834, passed as surgeon in 1838, took his degree of Doctor of Medicine in 1839, and wrote a thesis "On the Certain Existence of Haloid Salts of the Electro Negative Metals in Solution." After taking his degree, chemistry became his favourite pursuit. He had studied the subject assiduously under Dr. Hope and Mr. Kenneth Kemp; and in 1836-37 he had been engaged for eighteen months as chemical assistant in Dr. Christison's laboratory, which was at that time the best school of analytical chemistry in the University. His first lectures on chemistry were given to private audiences, in the drawing-room of his father's house, in 1837. In a MS. journal kept by him, we find the following entries: — "September 20th, 1838"—"I meet with scarcely one lady in ten or fifty, who has sufficiently cultivated her natural intellectual powers." . . . "This winter shall see me do my utmost to suggest an improvement among my own small circle."

"May 1839. Following out the proposal to amend the subjects of ladies' conversation and study, I assembled some of them in my father's house, and delivered a course of prelections on chemistry, especially the chemistry of nature. This was in the winter of 1837-38, so that I was then not nineteen. The majority of my audience were older than myself by a year or two. I was greatly praised and encouraged, most kindly listened to, and assisted in many ways, especially by J. M'G., a generous, unselfish, happy fellow, without whose aid I should have come on very poorly. This course, which began in October, was first interrupted by the illness of my sister, and afterwards by the mournful indis-

position of my cousin C.; so that only ten or twelve lectures were given.

Subsequently to this Dr. Wilson went to London, and entered the laboratory of University College, under the superintendence of Professor Graham, now Master of the Mint. There, with Dr. Lyon Playfair, Mr. James Young of Glasgow, Dr. Livingstone, the African traveller, and other zealous students, he carried on his chemical pursuits for a period of six months.

He began to lecture publicly on chemistry in Edinburgh in 1840. About this time, however, his health began to suffer, apparently in consequence of excessive exertion during a pedestrian excursion in the Highlands with a cousin. His first course of lectures was arranged when he was confined to bed, and he was scarcely convalescent when he commenced the session of November, 1840. His health continued broken after this. An attack of rheumatism was followed by disease of the ankle-joint, which ultimately called for amputation. This was performed in January 1843, by his friend, and afterwards his colleague, Professor Syme. Amputation seemed to offer the only hope of relief, and Mr. Syme proposed disarticulation. Accordingly, he performed this operation; and as the articulating surfaces of the joint were everywhere divested of cartilage, rough and carious, instead of removing the malleolar projections separately, he exposed the bone sufficiently to saw off both together, with a thin lamina of the tibia connecting them. This was the first instance in which Professor Syme amputated through the ankle-joint for disease of the joint. It is therefore interesting in the annals of surgery. The case proceeded favourably. The feelings which Dr. Wilson experienced previous to the operation, and during its performance, are graphically portrayed by him in a letter on "the Anæsthetics of Surgery," which he addressed to Professor Simpson, and which is published in Simpson's Obstetric Works, edited by Drs. Priestley and Storrer, Vol. II., p. 796. He contrasts the condition of patients in his day, before the use of chloroform, with their state at the present time:—

"Several years ago," he says, "I was required to prepare, on very short warning, for the loss of a limb by amputation. A painful disease, which for a time had seemed likely to yield to the remedies employed, suddenly became greatly aggravated, and I

was informed by two surgeons of the highest skill, who were consulted on my case, that I must choose between death and the sacrifice of a limb,—and that my choice must be promptly made, for my strength was fast sinking under pain, sleeplessness, and exhaustion. I at once agreed to submit to the operation, but asked a week to prepare for it, not with the slightest expectation that my disease would take a favourable turn in the interval, or that the anticipated horrors of the operation would become less appalling by reflection upon them; but simply because it was so probable that the operation would be followed by a fatal issue, that I wished to prepare for death, and what lies beyond it, whilst my faculties were clear and my emotions were comparatively undisturbed. For I knew well that if the operation was speedily followed by death, I should be in a condition, during the interval, in the last degree unfavourable to making preparation for the great change."

During the interval, he diligently and prayerfully studied the Bible, and at the end of a week the operation was performed. There were no anæsthetics in those days, and the operation was a very painful and somewhat tedious one. Not being gifted with great physical courage, he was one of those to whom cutting, bruising, burning, or any similar physical injury, even to a small extent, was a source of suffering never willingly endured, and always anticipated with more or less apprehension. He states that he could never forget the black whirlwind of emotion, the horror of great darkness, and the sense of desertion by God and man, bordering almost upon despair, which swept through his mind and overwhelmed his heart. Chloroform would have been the greatest boon to him. From his relations he concealed the impending operation, fearing that the expression of their grief would shake his resolution. They were not aware of what had happened until the surgeons made it known to them. "During the operation," he continues, "in spite of the pain it occasioned, my senses were preternaturally acute; I watched all that the surgeons did with fascinated intensity. I still recall with unwelcome vividness the spreading out of the instruments, the twisting of the tourniquet, the first incision, the fingering of the sawed bone, the sponge pressed on the flap, the tying of the blood-vessels, the stitching of the skin, and the bloody dismembered limb lying on the floor." He then dwells on the value of anæsthetics, and con-

cludes thus:—"The sum, you will perceive, of what I have been urging is, that the *unconsciousness* of the patient secured by anæsthetics, is scarcely less important than the painlessness with which they permit injuries to be inflicted on him."

Forbes was an older student than Wilson, and had attained eminence as a rising naturalist before their acquaintance began. He was a genius in science who had the wonderful power of attracting followers, and of stimulating to exertion. Forbes' influence told in no small degree on the mind of Wilson, who afterwards undertook to write his Biography. This work occupied his leisure hours ever since the lamented death of his friend; but we fear that little more than half the task has been completed. In a MS. note-book, the chapters of the Life of Forbes are sketched out thus:—

1. Isle of Man. 2. Boyhood and School Life. 3. London Artist Life. 4. The University of Edinburgh. 5. The Student Life of E. F. 6. The Sea Naturalist. 7. The Mediterranean Cruise. 8. The London Chair of Botany. 9. The Geological Survey. 10. The Edinburgh Class of Natural History. 11. The Artist and Litterateur. 12. The End. 13. Epilogue.—Of these the first five chapters are ready for the printer, and the sixth seems also to be finished, though not copied out. As the materials have all been accumulated, it is earnestly hoped that the work may be completed by other hands.

Up to manhood the vigour and elasticity of his health was unusual; but from the year 1842 to the end of his career, a thorn in the flesh never ceased to buffet him. It was during this illness that his attention was specially directed to matters of eternal moment. The bed of affliction was made to him a blessing. The chastening of the Lord was for his profit. There happened at that time to be a student at the Divinity Hall who became acquainted with Dr. Wilson, and was a constant visitor at his house. This was the present Rev. Dr. Cairns of Berwick. The friendship which sprung up between Dr. Cairns and himself was of the warmest kind, and continued throughout the remainder of life. Their fellowship was cemented by holier ties than any of a mere earthly nature. Dr. Wilson always regarded Dr. Cairns as his spiritual father, whose counsels encouraged him, and whose ministrations at the hour of death helped to cheer his spirit. What he owed to God's discipline during his life was ever gratefully present to his mind.

His recovery from his severe illness was tedious, and he was rendered unfit for public duty for some time. His father died very suddenly in April 1843, and this added not a little to his sufferings.

The commencement of Dr. Wilson's career as a lecturer was thus also that of his ill health. His weak body seemed often to be sinking into the dust, while his noble spirit ignored its fetters, and seemed to rise above the feebleness of the flesh. For fifteen years he continued to teach as a private lecturer, and he acquired eminence and celebrity. In 1844 he was appointed by the Directors of the School of Arts their lecturer on chemistry; and in the same year, with the sanction of the Highland and Agricultural Society, he became lecturer in the Veterinary College of Edinburgh. Between 1844 and 1852 he continued to deliver regularly nine lectures on chemistry every week during the six winter months, and at a later period of his history he even delivered thirteen.

Dr. Wilson had a peculiar power of making science popular, and describing intricate subjects in such a way as to make them plain to a common audience. His inventive powers in illustrating his lectures were remarkable. His graceful diction and æsthetic taste, combined with his play of fancy and of genial wit, gave peculiar attractions to his prelections, and crowded audiences hung on his lips whenever he appeared in public. In the Academic Hall, the Philosophical Institution, the learned society, and in the miserable lecture-room in the Cowgate or the Canongate, he was equally at home and equally successful.

The attention which he devoted to economical science, and to the applications of chemistry, pointed him out as the man best qualified to occupy the situation of Director of the Industrial Museum of Scotland. In the autumn of the same year he was chosen by the Crown to fill the newly-instituted chair of Technology in the University of Edinburgh.

The duties of this unendowed chair he fulfilled with the greatest ability and success. Although the class was not demanded for any academic honours, and was not included in any curriculum of study (except that of the Highland Society), still the talents of the Professor secured a large attendance. At the time of his death (although the entrance was not completed) the number of pupils was eighty-four, embracing students from all the Faculties and many amateurs. Nothing could more plainly indicate the

value put on his lectures. In his inaugural lecture he considers the subject, What is Technology? and he thus writes: "Technology is the sum or complement of all the sciences which either are or may be made applicable to the industrial labours or utilitarian necessities of man. While the subject has a connection with various subjects already taught in the University, it steers a course distinct from all, has a province of its own, and will not, when properly handled, interfere with the duties of any other professor."

The full course of technology embraced three sessions, in each of which certain of the industrial arts were made the subject of lecture, which were not discussed in the other two. The course was divided into Mineral, Vegetable, and Animal Technology. Under the first were included the relation of the atmosphere, the ocean and tributary waters, and the earth, to technology; and among special subjects, fuel, building material, glass and glass-making, pottery, earthenware, stoneware, and porcelain, metallotechny, electrotechny, and magnetotechny. Under the second or Vegetable Technology, were considered: saccharoamylaceous substances, sugar-making, albuminous substances and fermentations, distillation, wood and wood-fibres, textile tissues, bleaching, dyeing calico-printing, paper-making, scriptorial or graphic industrial arts, caoutchouc, gutta-percha, and the resins, fats and oils. Under the third section, or Animal Technology, were included the mechanical application and chemical products of bones, ivory, horns, hoofs, tortoise-shell, shells, and corals; skins, tanning, fish-scales; hair, fur, wool, bristles, quills and feathers, animal refuse.

The lectures were fully illustrated by experiments and drawings, and by specimens from the natural history collections and the Industrial Museum. Occasion was taken throughout the course to visit various manufactures.

Besides occupying these important positions in the University and in the Museum, Wilson was also an active member of many societies, and contributed papers to their Transactions, as will be seen by referring to the list of his publications. He was twice elected a member of Council of the Royal Society of Edinburgh; he was a member of the Council of the Chemical Society of London; a member of the Chemical Committee of the Highland and Agricultural Society, and one of the examiners for the Agricultural Diploma; an honorary member of the Pharmaceutical Society of Great Britain; and he had been twice president of the

Royal Scottish Society of Arts, and for some time editor of its "Transactions."

A growing holiness, sweetness, and patience, had been markedly visible in Dr. Wilson of late years. In times of sickness and dangerous illness, there was ever a serene calmness and cheerfulness, that seemed greatly to aid recovery. His patient endurance of suffering was remarkable. Patience wrought experience, and experience hope—even that hope which maketh not ashamed. He was always ready for his great change. About six months ago, when saying good bye on a morning visit to a friend, he said, "I am trying to live every day, so that I may be ready to go on an hour's notice." To another he used the remarkable expression, "I am resigned to live."

His feeble health at the commencement of the Session 1859 was ill calculated to fit him for the arduous duties he had undertaken, and there seemed to be in his own mind a feeling that he was not likely to survive long.

In the last few days of his life his serenity was more obvious than at any previous time. So well was it known that, living or dying, he was the Lord's, that the anxieties of a death-bed season were as much lightened as is possible in this life. His death was more like a child going to sleep than anything else.

He commenced his lectures in November 1859 with high prospects of success. His introductory lecture was characterised by his usual felicitous illustrations, and the class-room was crowded to the door.

His last illness began from exposure to cold and wet in a manufactory in the west, on the morning of Friday, 4th November. He had gone there to acquaint himself with the particulars of a Court of Session case relating to the dyeing mauve-coloured silk. On the morning of Friday, 18th November, he complained of a pain in his side, but he treated it as a pleurodynic attack, and went to lecture as usual. He was, however, much exhausted; and in spite of this he continued to write letters, receive visitors and make business calls, and he even ventured to give a second, lecture in the afternoon. This seemed to prostrate him completely, and he had to apologise to the class for taking a seat in place of standing during the lecture as usual. When he reached home he was scarcely able to get up stairs to bed, from whence he never rose.

On the morning of Tuesday, 22d November, there appeared to be a slight alleviation of symptoms, but it was a temporary rally. Ere long it was evident that he was sinking. He was peaceful and happy, when he breathed his last.

The respect and affection with which he was regarded were well shown in the public funeral, which was attended by Professors of the University, the Lord Provost, Magistrates, and Council, the Colleges of Physicians and Surgeons, members of the Royal Society, Royal Scottish Society of Arts, Royal Physical Society, Botanical Society, Philosophical Institution, School of Arts, Merchant Company, Chamber of Commerce. His friends, the Rev. Dr. Alexander and the Rev. Dr. Cairns, officiated on the occasion. His remains were interred in the Old Calton Burying-ground on 28th November, and his funeral sermon was preached by Dr. Alexander, in the Music Hall, to an overwhelming audience, on 4th December—the text being, "Blessed are the dead that die in the Lord," Rev. xiv. 13.

While Wilson's lectures threw a genial light on the facts of science, his writings contributed not less to extend and popularise them. Everything he touched became instinct with life, and was impressed upon the mind of the hearer or reader by associations of the most pleasing and lasting nature. His collected writings will undoubtedly be an important contribution to literature.

"The effort of his life." Dr. Cairns remarks, "was to render science at once more human and more divine. His heart was strung throughout in sympathy with the touching prayer of the *Novum Organon*, that all science may become a healing art; and his last public office was regarded by him with special affection, as ministering to industrial progress and happiness. No scientific writer of our day has so habitually and lovingly quoted the Bible, from his essay on Dalton, whom he represents as proving that God literally 'weighs the mountains in scales, and the hills in a balance,' down to his last paper, which closes with marking the identity of Professor Thomson's astronomical proof of the evanescence of the heavens with the words of the 102d Psalm. He hoped to live to write a 'Religio Chemici,' corresponding to Sir Thomas Browne's 'Religio Medici,' and embracing amongst other topics of discussion the doctrine of the resurrection."

"To have moved, amidst the altitudes and solitudes of science with a humble and loving heart; to have spoken out words on

the sacredness of medicine as a profession and scientific life in general, more lofty than have almost been heard even from the pulpit, and to have illustrated them in practice; to have enforced the subjection of all knowledge to one Name, the highest in earth and heaven; to have conquered by faith in a life-long struggle with pain and suffering; and to have wrought out the work of the day placidly and devoutly till the night came;—these, in any, and especially in the leaders of science, are processes and results greater than can be described in the transactions of any society, or preserved in any museum."

We conclude these notices from the North British Review with a beautiful tribute of affection from the pen of his brother Dr. D. Wilson of Toronto, published in the "Canadian Journal," for March.

"Death has been busy of late among Edinburgh men whom I counted my personal friends. Dr. Samuel Brown, Professor Edward Forbes, and Hugh Miller, have followed one another to the grave within a brief period, and ere the past year drew to a close, Dr. George Wilson was added to the number of those who live only in honored memory. Dying at the early age of forty-one, when a career full of rich promise appeared only opening before him, and his mind seemed to be ripening in many ways for a great life-work: those who knew his capacity and his genius regard all that he had accomplished as insignificant indeed when compared with what he would have done if spared to those years in which men chiefly fulfil the promises of youth. Yet what he did accomplish, amid many and sore impediments to progress, is neither poor nor of small amount. Nor is it a light thing now to remember that one whose years of public life have been so few, and even these encroached on by the ever increasing impediments of failing health, has been laid in his grave amid demonstrations of public sorrow such as have rarely indeed been accorded, in that native city of his, to Edinburgh's greatest men. This was due even more to the genial kindliness and worth of a noble Christian man, than to the unwearied zeal of a popular public teacher, and an enthusiastic student of science. His loss to his university is great, but to his friends it is irreparable. In him the faith of science, and the nobler faith of the Christian, were blended into perfect harmony: for no doubt springing from half-revealed truths of science ever marred the serene joy of his faith while looking at

the things which are not seen. Prejudice and falsehood, ignorance and vice, were felt by him to be the common foes of both; and pardon me, if I add, that no man I have ever known carried more genially and unobtrusively, yet more thoroughly, his earnest Christian faith into all the daily business and the duties of life.

When a man of such genuine kindliness and worth is suddenly called away in his prime, with still so much of his life-work seemingly waiting its accomplishment, it is as when a brave vessel founders in mid-ocean. The wild eddy of the troubled waters gathers around the fatal gulf, and a cry of sympathetic sorrow rises up as the news is borne along to distant shores. But the ocean settles back to its wonted flow where that gallant bark went down, and the busy world soon returns to its old absorbing occupations. But there are those to whom that foundered bark has been the shipwreck of a life's hopes; and to me the loss of my life-long friend and brother will make life's future years wear a shadow they could never wear before."

ARTICLE XV.—*Notice of Tertiary Fossils from Labrador, Maine, &c., and Remarks on the Climate of Canada in the Newer Pliocene or Pleistocene Period.* By J. W. DAWSON, LL.D., F.G.S.

(Read before the Natural History Society.)

I am indebted to Capt. Orlebar, R.N., for a small collection of fossils from the vicinity of Tertiary Bay on the coast of Labrador, a locality in which similar collections were made several years since by Adm[l]. Bayfield. They occur in clay a little above high water mark; but the species present indicate a considerable depth at the time of the deposition of the bed in which they are contained, so that it cannot properly be regarded as merely a raised beach. The species contained in the collection are as follows; those found in the newer Pliocene of Canada being marked with asterisks.

Balanus porcatus.*
Spirorbis vitrea, attached to shells.*
Sp. carinata.
Buccinum undatum.*

Aporrhais occidentalis.
Natica, (fragment probably of *N. Clausa.*)*
Saxicava rugosa, var. *Arctica.**
Tellina proxima, (*calcarea*) *
Astarte elliptica.
*Rhynconella psittacea.**
Echinus granulatus.
Hippothoa catenularia, (attached to shells) *
*Lepralia pertusa.**
L. (not determined.)
Cythere.

The greater number of the above species have already been recognised in the tertiary clays of Canada; * but the following exceptions are deserving of notice.

Spirorbis vitrea, has not been named in my previous papers; but I now find, on comparison with the specimens from Labrador and recent examples from Gaspé, that it is this and not *Spirorbis sinistrorsa* as previously stated, that occurs in the tertiary beds at Montreal and Quebec. It is at present a deep water species in the Gulf of St. Lawrence and on the banks of Newfoundland. *Spirorbis carinata* has not previously been observed in the tertiary beds; but is common on the coast of Labrador and Gaspé.†

Aporrhais occidentalis, the American representative of the "Pelican's-foot Spout-shell" of Britain, and remarkable in the adult state for its singularly expanded outer lip, is a deep water shell somewhat widely though not very abundantly distributed on the American coast. I have specimens from Labrador, Sable Island, and Portland, where a very fine living specimen was dredged for me last summer by Mr. Ferrier.

Saxicava rugosa, occurs in the Labrador collection under the form described as *S. Arctica* by Forbes and Hanley. This form is not prevalent though sometimes seen among the *Saxicavæ* of the St. Lawrence valley deposits, and at present is I think found only in deep water. The intermediate specimens prove it to be merely a variety of the common species.

Astarte elliptica is the common *Astarte* of the Gulf of St.

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* See papers by the author in Canadian Naturalist, Vols. 2 and 4.

† See paper on *Spirorbes* of the Gulf of St. Lawrence in last number of this Journal.

Lawrence at present. Great numbers have been dredged by Mr Bell on the coast of Gaspé in about 60 fathoms. Along with them are found a few specimens having the characters of the typical *Astarte sulcata* of Great Britain, and others having the characters of *A. compressa*, a species much more nearly related than the others to the fossil *A. Laurentiana*, though quite distinct. I can recognise in the collections made by Mr. Bell and myself all the above species or varieties, and in addition the *A. Arctica*, which I have found only in the pleistocene beds near Portland. *A. Laurentiana* and *A. Arctica* are without doubt distinct species from *Sulcata*, but different views have been entertained as to the others. The distinction based by some authors on the crenulated or smooth margin, and on which the species *A. Scotica* and *A. Danmoniensis* have been founded, is evidently worthless, depending as it does on age; but the distinctions of external form and marking are apparently constant at all ages, and do not shade into each other. Although therefore Dr. Gould and Mr. Stimpson retain the name *sulcata* for all our American forms, I think it admits of a doubt whether the same distinctions made by Forbes and Hanley in Britain do not hold here. Mr. P. P. Carpenter when in Montreal very kindly went over my collections with me, and expressed himself satisfied that we have the forms recognised in Britain as *elliptica*, *sulcata*, and *compressa*, whatever their specific value. My impression at present is that *compressa* is a good species, but that *sulcata* and *elliptica* as we have them may be varieties of one. It is curious that while *A. Laurentiana* prevails exclusively in the St. Lawrence deposits, the modern species is found at Labrador; and very possibly, especially when we regard the more inland position and greater elevation of the former, this indicates a difference of age in the deposits.

The clay attached to and in the interior of Capt. Orlebar's specimens is very rich in the minute *Foraminifera*. It contains specimens of all the forms found in the clays of Montreal and described in my former papers, and in addition the following:

Rotalina oblonga, Fig. 1.
Bulimina pupoides, Fig. 2.
B. auriculata ?
Orbulina universa,
Textularia variabilis, Fig. 3.
Nonionina Labradorica, N. sp. Fig. 4.
Truncatulina lobata Fig. 5.

All of these except one are well known living species, and all except *Textularia variabilis* have been found in the Gulf of St. Lawrence. This last statement however could not have been made but for specimens obtained from clay taken up by the sounding lead off the coast of Anticosti, from depths varying from 144 to 313 fathoms, and for which also I am indebted to Capt. Orlebar. In these soundings there also occur *Globigerina bulloides* a species world-wide in its distribution, and *Nodosaria pyrula*, neither of which have as yet been found in the tertiary beds of Canada. With these recent shells there is a *Cythere* like *C. angulata* of the British seas, and numerous spicules of sponges; there are also immense numbers of the round perforated silicious shields of *Coscinodisci* apparently the *C. lineatus* and *C. radiatus* of Ehrenberg. It is a remarkable and at present unaccountable fact that while in the pleistocene beds there is a great abundance of foraminifera, sponge spicules, and valves of cythere, imbedded in calcareous clays like those of the deep soundings of the Gulf, the *Coscinodisci* and other diatoms are absent or at least have not been recognised.

Fig. 1.

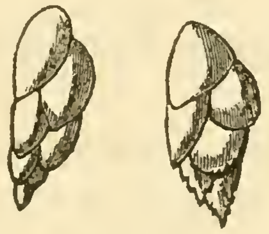

Fig. 2.

Fig. 3

Fig. 1.—*Rotalina oblonga.*
2.—*Bulimina pupoides.*
3.—*Textularia variabiltis.*

Truncatulina lobata. The last species in the list is a little parasitic foraminiferous shell adhering to shells, stones, and zoophytes. It abounds in Mr. Bell's and Mr. Richardson's recent collections from Gaspé, and since I observed it in Capt. Orlebar's collection, I have found it also at Montreal. It is the *Nautilus stellaris* of Fabricius.

The *Nonionina* which I name *N. Labradorica*, and which is found both recent and fossil, is a very beautiful species. It is perfectly equilateral, smooth and remarkably white and lustrous. It is most readily characterised by the great expansion of the last chamber, which spreads laterally and extends in two lobes on

either side of the earlier whorls. When seen from one side it resembles *Rotalina turgida*, for which indeed I mistook it at first; but when viewed in front it is seen to be equilateral and to have the characteristic septal aperture of Nonionina. It is about equal in size to *N. umbilicatula*, and has the last chamber inflated even in young shells.

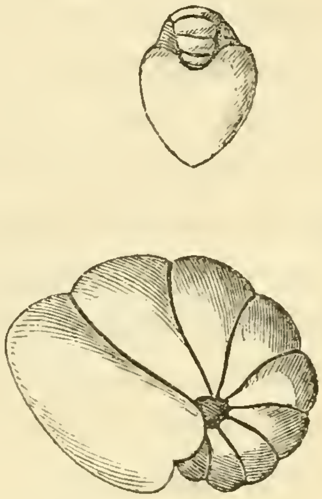

Fig. 4.

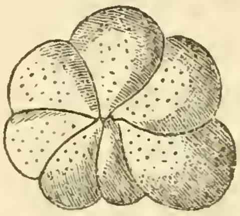

Fig. 5.

Fig. 4.—*Nonionina Labradorica*, N. sp.
5.—*Truncatulina lobata.*

The Foraminifera from the deeper parts of the Gulf are usually of small size, and this applies also to those from the pleistocene of Labrador.

In the past summer another deposit of pleistocene shells was discovered by Sir W. E. Logan at the Mingan Islands, Labrador. The specimens obtained from it consist of *Mya arenaria* and *Tellina proxima* in hard sand, and have the aspect of a littoral deposit corresponding to the "saxicava sand" of the vicinity of Montreal.

2. Portland, Maine.

In last August I enjoyed some opportunities of examining the tertiary deposits at and near Portland, and also at Pond Cove, Cape Elizabeth, where a small patch of this deposit occurs nearly at the level of the sea. At the south end of the city of Portland, in a deep railway cutting, the tertiary beds are well seen, and consist, in ascending order, of boulder clay, fossiliferous stratified clay and sand, and stratified sand and gravel. These beds appear to be very irregular, being entangled in ledges of metamorphic rock, which sometimes rise through them. The distinction between the deeper water and shallow water parts of the deposits is in

consequence less strongly marked than at Montreal, but is indicated by beds containing *Mytilus edulis* alone, overlying those which contain shells characteristic of the open sea. At Cape Elizabeth the pleistocene clays occupy depressions between ridges of slate. At the only place where I observed fossils, the deposit is a hard gray stony clay containing a mixture of deep sea and littoral shells. The bivalves are mostly in detached valves and often on edge, as if the bed had been subjected to the pressure of ice after its deposition.

The fossils observed in the above mentioned beds are as follows,—those common to Portland and the St. Lawrence valley being marked with asterisks :

Balanus crenatus,*
Fusus decemcostatus, (var. *borealis*,)
Buccinum undatum,*
Fusus scalariformis,
Natica clausa,*
Mytilus edulis,*
Mactra ovalis,
Saxicava rugosa,*
Astarte elliptica,
A. compressa,
A. arctica,
Tellina proxima,*
Pecten Islandicus,*
Mya truncata,*
Nucula Jacksoni,
Aphrodite Grœnlandica,
Lepralia variolosa,
L. Bellii,*
Membranipora, (undetermined.)

The assemblage of shells in the above list cannot be said to indicate any very great change of climate, though more like that of the Gulf of St. Lawrence than of Portland at present. With the exception of *Astarte arctica* not now found on the American coast, and *Nucula Jacksoni* which is possibly extinct, they are

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* A new species, now living in the Gulf of St. Lawrence, and decribed in the Report of the Geological Survey of Canada for 1858.

all common American species. It is curious that in the collections of the Canadian Geological Survey, the group of shells obtained by Mr. Bell and Mr. Richardson in dredging on the north coast of Gaspé in about 60 fathoms, is almost precisely that of these Portland beds.

On comparison with the St. Lawrence tertiaries, it will be seen that 8 out of 19 species are distinct. It is further to be observed that *Fusus decemcostatus* replaces the closely allied *F. tornatus.* that *Saxicava rugosa* is much less abundant, that modern Astartes appear instead of *A. Laurentiana*, and that *Mytilus edulis* is of large size and of the ordinary form. These differences are however probably nothing more than the effects of the more oceanic position of the Portland beds, as compared with the old inland sea of the St. Lawrence valley, and it will be observed that in respect to the Astartes the Portland beds correspond with those of Labrador. The less elevation of the Portland beds however renders it probable that they are somewhat newer than those of the St. Lawrence valley and of Lake Champlain.

In the cabinet of Dr. Jackson of Boston, I had an opportunity of examining a collection of about 14 species obtained by him from the beds on the Pressumpset River, described many years ago by Professor Hitchcock and Dr. Jackson. In this collection while several of the shells found at Portland are absent, I found *Leda Portlandica*,* *Nucula proxima*, *Terebratula septentrionalis*, *Mya arenaria*, and the carapace of a crab.

3. OCCURRENCE OF FRESH WATER SHELLS IN THE PLEISTOCENE BEDS.

I owe to the kindness of A. Dickson, Esq., additional collections of the fresh water shells and the sands containing them from Pakenham,† together with a communication from a gentlemen of that place giving a section of the deposits as seen in a deep road cutting. The arrangement is as follows in descending order :

Sand and surface soil, about,................	10 feet
Clay, ...	10 "

* Dr. Gould informs me that he is now satisfied of the correctness of the identification of this shell by Mr. Wood with the species *L. truncata* of the British Pleistocene and of the artic seas, where it has been found living.

† See my paper, Canadian Naturalist, Vol. IV.

Fine gray sand (shells of *Valvata*, &c.)........		2 inches
Clay, ...	1 foot	
Gray sand, laminated (*Tellina Greenlandica*),..		3 "
Clay, ...		8 "
Light gray sand (*Valvata, Cyclas, Paludina, Planorbis* and *Tellina*),...............		10 "
Clay, ...	1 foot	2 "
Brown sand and layers of clay, (*Planorbis* and *Cyclas*),...........................		4 "

The species were the same with those described in my previous papers, and the only marine shell is *Tellina Grœnlandica*, a species now found farther up in our estuaries than most others.

Mr. Dickson informs me that a similar case occurs near Clarenceville, about four miles from the United States frontier, and at an elevation of about ten feet above Lake Champlain. Specimens from this place contain large shells of *Unio rectus* and *U. ventricosus*, the latter with the valves cohering, and a *Lymnea*. Intimately mixed with these in sandy clay are valves of *Tellina Grœnlandica* and *Mya arenaria*.

I record these facts, without pledging myself to the conclusion that these deposits really mark the margins or river estuaries of the old Pleistocene sea of Canada; though they will certainly bear that interpretation. In farther connection with these facts, and in relation also to the question why marine fossils have not been found west of Kingston, Mr. Dickson informs me that fossil capelin are found on the Chaudière Lake, 183 feet above Lake St. Peters, on the Madawaska 206 feet, and at Fort Colonge Lake 365 feet above the same level, a very interesting indication of the gradual recession of the capelin spawning grounds, from this last high elevation to the level of the more celebrated locality of these fossils at Green's Creek. Farther, throughout the Counties of Renfrew, Lanark, Carlton and Leeds, the marine deposits rise to an elevation of 425 feet, or nearly the same with that which they reach on Montreal Mountain; but while this elevation would with the present levels of the country carry a deep sea to the head of Lake Ontario, no marine fossils appear to have been found on the banks of that lake. Was the depression of the later pleistocene period limited to the country east of Lake Ontario, or have the marine deposits of the upper St. Lawrence hitherto escaped observation

or been removed by denuding agencies. The question awaits further explorations for a satisfactory answer.

In the mean time it is certain that the boulder clay and deposits corresponding in arrangement and mechanical character to the Leda clay and Saxicava sand of the Lower St. Lawrence, exist in these more western regions, though they have not been found to contain marine fossils.

4. CLIMATE OF CANADA IN THE PLEISTOCENE PERIOD.

The climate of this period and the causes of its difference from that which now obtains in the northern hemisphere, have been fertile subjects of discussions and controversies, which I have no wish here to re-open. I merely propose to state in a manner level to the comprehension of the ordinary reader, the facts of the case in so far as relates to Canada, and an important infe- ence to which they appear to me to lead, and which if sustained will very much simplify our views of this question.

Every one knows that the means and extremes of annual temperature differ much on the opposite sides of the Atlantic. The isothermal line of 40° for example passes from the south side of the gulf of St. Lawrence, skirts Iceland and reaches Europe near Drontheim in Norway. This fact, apparent as the result of observations on the temperature of the land, is equally evidenced by the inhabitants and physical phenomena of the sea. A large proportion of the shell fish inhabiting the gulf of St. Lawrence and the coast thence to Cape Cod, occur on both sides of the Atlantic, but not in the same latitudes. The marine fauna of Cape Cod is parallel in its prevalence of boreal forms with that of the south of Norway. In like manner the descent of icebergs from the north, the freezing of bays and estuaries, the drifting and pushing of stones and boulders by ice, are witnessed on the American coast in a manner not parallelled in corresponding latitudes in Europe. It follows from this that a collection of shells from any given latitude on the coasts of Europe or America, would bear testimony to the existing difference of climate. The geologist appeals to the same kind of evidence with reference to the climate of the later tertiary period, and let us enquire what is its testimony.

The first and most general answer usually given, is that the pleistocene climate was colder than the modern. The proof of this in Western Europe is very strong. The marine fossils of this

period in Britain are more like the existing fauna of Norway or of Labrador than the present fauna of Britain. Great evidences exist of driftage of boulders by ice, and traces of glaciers on the higher hills. In North America the proofs of a rigorous climate and especially of the transport of boulders and other materials by ice are equally good, and the marine fauna all over Canada and New England is of boreal type. In evidence of these facts I may appeal to the papers and other publications of Sir C. Lyell and Professor Ramsay on the formations of the so called glacial period in Europe and America,* and to my own previous papers on the tertiaries of Canada.

Admitting however that a rigorous climate prevailed in the pleistocene period, it by no means follows that the change has been equally great in different localities. On the contrary while a great and marked revolution has occurred in Europe, the evidences of such change are very much more slight in America. In short, the causes of the coldness of the pleistocene seas to some extent still remain in America, while they must have disappeared or been modified in Europe.

If we enquire as to these causes as at present existing, we find them in the distribution of ocean currents, and especially in the great warm current of the gulf stream, thrown across from America to Europe, and in the Arctic currents bathing the coasts of America. In connection with these we have the prevailing westerly winds of the temperate zone, and the great extent of land and shallow seas in Northern America. Some of these causes are absolutely constant. Of this kind is the distribution of the winds depending on the earth's temperature and rotation. The courses of the currents are also constant, except in so far as modified by coasts and banks; and the direction of the drift-scratches and transport of boulders in the pleistocene both of Europe and America, show that the arctic currents at least have remained unchanged. But the distribution of land and water is a variable element, since we know that in the period in question nearly all northern Europe, Asia and America were at one time or another under the waters of the sea, and it is consequently to this cause that we must mainly look for the changes which have occurred.

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* Lyell's travels in North America, Ramsay on the glaciers of Wales, and on the glacial phenomena of Canada. See also Forbes on the fauna and flora in the British Islands, in Memoirs of geological survey.

Such changes of level must, as has been long since shown by Sir Charles Lyell, modify and change climate. Every diminution of the land in arctic America must tend to render its climate less severe. Every diminution of land in the temperate regions must tend to reduce the mean temperature. Every diminution of land any where must tend to diminish the extremes of annual temperature; and the condition of the southern hemisphere at present shows that the disappearance of the great continental masses under the water would lower the mean temperature but render the climate much less extreme. Glaciers might then exist in latitudes where now the summer heat would suffice to melt them, as Darwin has shown that in South America glaciers extend to the sea level in latitude 46° 50′; and at the same time the ice would melt more slowly and be drifted farther to the southward. Any change that tended to divert the arctic currents from our coasts would raise the temperature of their waters. Any change that would allow the equatorial current to pursue its course through to the Pacific or along the great inland valley of North America, would reduce the British seas to a boreal condition.

The boulder formation and its overlying fossiliferous beds prove, as I have in a previous paper endeavoured to explain with regard to Canada, and as has been shown by other geologists in the case of other regions, that the land of the northern hemisphere underwent in the later tertiary period a great and gradual depression and then an equally gradual elevation. Every step of this process would bring its modifications of climate, and when the depression had attained its maximum there probably was as little land in the temperate regions of the northern hemisphere as in the southern now. This would give a low mean temperature and an extension to the south of glaciers, more especially if at the same time a considerable arctic continent remained above the waters, as seems to be indicated by the effects of extreme marine glacial action on the rocks under the boulder clay. These conditions, actually indicated by the phenomena themselves, appear quite sufficient to account for the coldness of the seas of the period, and the wide diffusion of the gulf stream caused by the subsidence of American land, or its entire diversion into the Pacific basin*, would give that assimilation of the American

* This is often excluded from consideration, owing to the fact that the marine fauna of the gulf of Mexico differs almost entirely from that of the Pacific coast; but the question still remains whether this difference existed in the later tertiary period, or has been established in the modern epoch, as a consequence of changed physical conditions.

and European climates so characteristic of the time. The climate of western Europe in short, would under such a state of things be greatly reduced in mean temperature, the climate of America would suffer a less reduction of its mean temperature, but would be much less extreme than at present; the general effect being the establishment of a more equable but lower temperature throughout the northern hemisphere. It is perhaps necessary to add that the existence on the land, during this period of depression, of large elephantine mammals in northern latitudes, as for instance the Mammoth and Mastodon, does not contradict this conclusion. We know that these creatures were clothed in a manner to fit them for a cool climate, and an equable rather than a high temperature was probably most conducive to their welfare, while the more extreme climate consequent on the present elevation and distribution of the land may have led to their extinction.

The establishment of the present distribution of land and water. giving to America its extreme climate, leaving its seas cool and throwing on the coasts of Europe the heated water of the tropics, would thus affect but slightly the marine life of the American coast, but very materially that of Europe, producing the result so often referred to in these papers, that our Canadian Pleistocene fauna differs comparatively little from that now existing in the gulf of St. Lawrence, though in so far as any difference subsists it is in the direction of an arctic character. The changes that have occurred are perhaps all the less that so soon as the Laurentide hills to the north of the St. Lawrence valley emerged from the sea, the coasts to the south of these hills would be effectually protected from the heavy northern ice drifts and from the arctic currents, and would have the benefit of the full action of the summer heat, advantages which must have existed to a less extent in western Europe.

It is farther to be observed that such subsidence and elevation would necessarily afford great facilities for the migration of arctic marine animals, and that the difference between the modern and newer pliocene faunas must be greatest in those localities to which the animals of temperate regions could most readily migrate after the change of temperature had occurred.

It has been fully shown by many previous writers on this subject, that the causes above referred to are sufficient to account for all the local and minor phenomena of the stratified and unstra

tified drifts, and for the driftage of boulders and other materials, and the erosion that accompanied its deposition. Into these subjects I do not propose to enter; my object in these remarks being merely to give the reasons for my belief stated in previous papers on this subject, that the difference of climate between pleistocene and modern Canada, and the less amount of that difference relatively to that which has occurred in western Europe, may be explained by a consideration of the changes of level which the structure and distribution of the boulder clay and the overlying fossiliferous beds prove to have occurred.

ARTICLE XVI.—*Abridged Sketch of the life of Mr. David Douglas, Botanist, with a few details of his travels and discoveries.*

(*Continued from last Number.*)

Turning with the boats as far back as Wallawalla, Douglas proceeded on horseback to the Fourches de l'Eau claire, up the south branch of the Columbia about 150 miles. The party which he accompanied thither came this length for the purpose of trading horses, but getting into difficulties with the Shohoptins, or Nez-perces Indians, and Mr. Douglas finding that little new could be obtained in that quarter, his steps were bent right north to Spokan House, where he was again kindly welcomed by the old hunter Jacquo Finlay. After parting with Jacquo, in crossing the Cedar river lying between Spokan and the Columbia, his horse stuck in the mud, and in the struggle to get extricated the rider was struck a sharp blow that threw him headlong into the water. This misfortune cost him his knapsack, which contained all the seeds he had collected, and his note-book, which were lost in the stream. In this trim he pursued his route, reaching Fort Colvile on the 5th of August, where he found Mr. John Dease in charge. An account of a fray between the natives, viz, the Kettle Falls Indians, and a portion of the Cootanies Tribe, who had come to this quarter for the purpose of fishing, is thus given by Douglas.—

" The parties met to day stark naked, at our camp, painted " some red, some black, others white and yellow, all with their bows

" strung, while those who had guns and ammunition, brought their " weapons charged and cocked. War caps, made of the Calumet " Eagle's feathers, were the only particle of clothing they had on. " Just as one of these savages was discharging an arrow from his " bow, aimed at a chief of the other party, Mr. Dease hit him " such a blow on the nose as stunned him, aad the arrow fortunately " only grazed the skin of his adversary, passing along the rib op- " posite to his heart, without doing him much injury. The " whole day was spent in clamour and haranguing, and unable to " foresee what the issue might be, we were prepared for the worst. " Mr. Dease, however, succeeded in persuading them to make " arrangements for peace, and begged this might be done without " delay on the morrow, representing to them how little they had " ever gained by their former wars, in which they had mutually " butchered one another like dogs. Unluckily for me, my guide, " *the Wolfe*, is equally wanted by his party, whether to make war " or peace, therefore, I am obliged to wait for him.

On the 19th he bade adieu to Mr. Dease, taking horse to Okawyan, where he procured a guide and small canoe. Soon after embarking, in descending a rapid, he took the precaution of walking along shore, carrying with him his papers, plants, seeds, and blanket. While thus occupied, the canoe in descending was struck by a surge in the rapid, and emptied of all its contents except a little dried meat which had been fixed in hard, in the narrow part of the bow. Deprived thus of cooking utensils, or any of the slightest comfort or convenience in the shape of travelling appointment, he pursued his course to Wallawalla, where finding a fresh guide, he continued onward and, after some trouble, as well as assistance from Indians, landed on the first day of August on the Beach above Fort Vancouver. This journey is thus closed very expressively in his own words.—

" In poor plight, weary and travel-soiled, glad at heart, though " possessing nothing but a shirt, leather trousers, and old hat, hav- " ing lost my jacket and neck-kerchief, and worn out my shoes, I " made my way to the fort, having traversed eight hundred miles " of the Columbia valley in twelve days, unattended by a single " person except my Indian guides."

His collections were now shipped for England, consisting of a great mass of dried specimens of plants besides Zoological subjects. The seeds which he had forwarded these two first years on the

Columbia, to the Horticultural Society, were the means of introducing to the knowledge of gardeners above 160 new flowers and plants, all interesting, many of utility, others of uncommon splendor and beauty. Among these were 14 species of *currant*, 5 of *Raspberry* and 2 of *Berberry*, while the flower garden bloomed with 2 new species of *Brodicea*, 2 of *Calochortus*, 3 of *Caprifolium*, 3 of *Clarkia*, 2 of *Clintonia*, 5 of *Collonia*, 3 of *Collinsia*, 3 of *Eutoca*, 5 *Gilias*, 24 *Lupines*, 5 of *Minculus*, 10 of *Œnothera*, 13 of *Penstemon*, 6 of *Potentilla*, and 3 of *Spirea*, besides many single species of other genera—altogether an accession to the shrubbery and flower-garden which must ever be highly appreciated. On the 15th of September Mr. Douglas accompanied a trapping party to the southward or the Umptqua country, with the view principally of procuring cones and seeds of the large pines there growing in the greatest perfection. At this time the Umptqua river was but little known, and only occasionally visited by interpreters or clerks of the Fur trade, for the purpose of bartering with the natives. The mode of travelling suited the botanist well. He had time to look about him, and gather much in the Willamette valley. A month elapsed, but on the 16th of October he arrived on the heights overlooking the Umptqua, the last days having been occupied in passing amongst timber of enormous growth and through thickly wooded forests where the path was frequently obstructed by fallen trees, measuring from 200 to 250 feet in length. Here first commences the district of the Californian laurel, the *Oreodapnue Californica*, which perfumes the air in every direction with its odours. Our Adventurer did not reach the wished for groves of *Pinus Lambertiana* without risk and danger. Having obtained a guide in the person of a youth who had been brought from the southward as a slave, he started from the trapping camp on the 18th, next day, however, having fallen into a gully in pursuit of a wounded deer, he was so much stunned and hurt as to be obliged to return to camp. Whence he again sallies on the 23rd, in pursuit of the great Pine. Proceeding due south, we find him on the 25th of the month not far from the object of his search, but very disagreeably lodged as his journal thus shows.—

" Wednesday the 25th. Last night was one of the most dread-
" ful I ever witnessed ; the rain falling in torrents, was accom-
" panied by so much wind as made it impossible to keep in a fire ;

" and to add to my miseries the tent was blown down about my " ears, so that I lay till daylight, rolled in my wet blanket on " *Pteris aquilina*, with the drenched tent piled above me, Sleep " was of course not to be procured ; every few minutes the falling " trees came down with a crash which seemed as if the earth " was cleaving asunder, while the peals of thunder and vivid " flashes of forky lightening produced such a sensation of terror " as had never filled my mind before, for I had at no time exper- " ienced a storm under similar circumstances of lonliness and un- " protectedness of situation. Even my poor horses were unable to " endure it without craving, as it were, protection from their master " which they did by cowering close to my side, hanging their heads " upon me and neighing. Towards daylight the storm abated, " and before sunrise the weather was clear, though very cold. I " could not stir without making a fire, and drying some of my " clothes, every thing being soaked through ; and I indulged " myself with a pipe of tobacco, which was all I could afford. " At ten o'clock I started, still shivering with cold, though I had " rubbed myself so hard with a handkerchief that I could no " longer endure the pain. Shortly after I was seized with intense " headache, pain in the stomach, giddiness and dimness of sight. " All the medicine I had being reduced to a few grains of calomel, " I felt unwiling, without absolute necessity, to take to this last " resource, and therefore threw myself into a violent perspiration " by strong exercise, and felt somewhat relieved towards evening, " before which time I arrived at three lodges of Indians, who " gave me some fish,. The food was such as I could hardly have " eaten if my destitution were less. Still I was thankful for it, " especially as the poor people had nothing else to offer me ; the " night being dry, I camped early in order to dry the remaining " part of my clothing."

" Thursday the 25th. Weather dull, cold, and cloudy. When " my friends in England are made acquainted with my travels, I " fear they will think that I have told them nothing, but my " miseries, This may be true, but I now know as they may do " also, if they choose to come here on such an expedition, " that the objects of which I am in quest, cannot be obtained " without labour and anxiety of mind, and no small risk of " personal safety, of which latter statement my this day's adven- " tures are an instance. I quitted my camp early in the morning

" to survey the neighbouring country, leaving my guide to take " charge of the horses until my return in the evening, when I " found that he had done as I wished, and in the interval dried " some wet paper which I had desired him to put in order. " About an hour's walk from my camp, I met an Indian, who on " perceiving me instantly strung his bow, placed on his left arm a " sleeve of Racoon skin, and stood on the defensive. Being quite " satisfied that this conduct was prompted by fear, and not by " hostile intentions, the poor fellow having probably never seen " such a being as myself before, I laid my gun at my feet, on the " ground and waved my hand for him to come to me, which he " did slowly and with great caution. I then made him place his " bow and quiver beside my gun, and striking a light gave him a " smoke out of my own pipe, and a present of a few beads. " With my pencil I made a rough sketch of the cone and pine " tree which I wanted to obtain, and drew his attention to it, " when he instantly pointed with his hand to the hills fifteen or " twenty miles distant, towards the south; and when I expressed " my intention of going thither, cheerfully set about accompany- " ing me. At midnight I reached my long-wished-for pines, and " lost no time in examining them, and in endeavoring to collect " specimens and seeds. New and strange things seldom fail to " make strong impressions and are therefore, frequently over-rated; " so that lest I should never again see my friends in England to " inform them verbally of this most beautiful and immensely " grand tree, I shall here state the dimensions of the largest I " could find among several that had been blown down by the " wind. At three feet from the ground its circumference is 57 ft. " 9 inches; at 134 ft., 17 ft. 5 inches; the extreme length 245 ft. " The trunks are uncommonly straight, and the bark, remarkably " smooth for such large timber, of a whitish or light brown colour, " and yielding a great quantity of bright amber gum. The tallest " stems are generally unbranched for two thirds of the height " of the tree; the branches rather pendulous with cones " hanging from their points like sugar loaves in a grocer's " shop. These cones, are however, only seen on the loftiest trees, " and the putting myself in possession of three of these, (all I " could obtain) nearly brought my life to a close. As it was im- " posible either to climb the tree or hew it down, I endeavoured " to knock of the cones by firing at them with ball, when the re-

" port of my gun brought eight Indians, all of them painted with " red earth, armed with bows, arrows, bone tipped spears and flint " knives. They appeared anything but friendly. I endeavoured " to explain to them what I wanted, and they seemed satisfied " and sat down to smoke, but presently I perceived one of them " string his bow, and another sharpen his flint knife with a pair of " wooden pincers, and suspend it on the wrist of the right hand. " Further testimony of their intentions was unnecessary. To save " myself by flight was impossible, so without hesitation I stepped " back about five paces, cocked my gun drew one of the pistols " out of my belt, and holding it in my left hand, and the gun in " my right, showed myself determined to fight for my life. As " much as possible, I endeavoured to preserve my coolness, and " thus we stood looking at one another, without making any move- " ment or uttering a word, for, perhaps, ten minutes, when one, " at last, who seemed the leader, gave a sign that they wished " for some tobacco : this I signified that they should have, if they " fetched me a quantity of cones. They went off immediately " in search of them, and no sooner were they all out of sight, than " I picked up my three cones and some twigs of the trees, and " made the quickest posssible retreat, hurrying back to my camp, " which I reached before dusk, the Indian who last undertook to " be my guide to the trees I sent off before gaining my encamp- " ment, lest he should betray me. How irksome is the darkness " of night to one under my present circumstances ! I cannot " speak a word to my guide, nor have I a book to divert my " thoughts, which are continually occupied with the dread lest the " hostile Indians should trace me hither and make an attack ; I " now write lying on the grass, with my gun cocked beside me, " and penning these lines by the light of a Columbian candle, " namely, an ignited piece of rosiny wood.—To return to the " tree which nearly cost me so dear, the wood is remarkably fine " grained and heavy ; the leaves short and bright green, inserted " five together, in a very short sheath ; of my three cones, one " measured fourteen inches and a half, and the two others are " respectively half an inch and an inch shorter, all full of fine " seed. A little before this time of year, the Indians gather the " cones and roast them on the embers, then quarter them and ' shake out the seeds, which are afterwards thoroughly dried and pounded into a sort of flour, or else eaten whole.

" Friday the 27th. My last guide went out at midnight in " search of trout, and brought me home a small one, which served " for breakfast. Two hours before daylight he rushed in with " great marks of terror uttering a shriek which made me spring " to my feet, as I concluded that my enemies of yesterday had " tracked out my retreat. He, however, gave me to understand, " by gesture that he had been attacked by a grizly bear. I " signed to him to wait till daylight, when I would go out and " look for, and perhaps, kill the creature. A little before sunrise, " Bruin had the boldness to pay us a visit, accompanied by two " cubs, one of last year's brood, and one of this; but as I could " not consistently with safety receive these guests before daylight, " I had all my articles deposited in the saddle-bags, and driven " upon one horse to a mile distant from the camp, when I returned " mounted upon the animal, Mr. McLoughlin had given me, and " which stands fire remarkably well, and found the bear and her " two young ones feeding on acorns under the shade of a large oak. " I allowed the horse to walk within twenty yards, when all three " stood up and growled at me. I levelled my gun at the heart of " the old one, but as she was protecting her young by keeping " them right under her, the shot entered the palate of one of " these, coming out at the back of the head, when it instantly fell. " A second shot hit the mother on the chest as she stood up with " the remaining cub under her belly, on which abandoning it, she " fled to an adjoining hummock of wood. The wound must have " been mortal, as these animals never leave their cubs until they " themselves are on the point of sinking. With the carcase of " the young bear I paid my last guide, who seemed highly to prize " the reward, and then abandoned the chase, deeming it only pru- " dent, after what happened yesterday, to retrace my steps towards " the camp of my friends. So I returned crossing the river two " miles lower down than formerly, and halted at night in a low " point of wood near a small stream.

" Saturday and Sunday, the 28th, and 29th. Both these days " being very rainy, as the day before also was, and having very " little clothing, I made all the exertion in my power to reach " Mr. McLeod's encampment near the sea. It was impossible to " keep myself dry, and the poor horses were so fatigued that I " was obliged to walk all the way and lead my own by the bridle, " the road becoming continually worse and worse from the floods

" of rain. On Saturday night I halted at my second crossing " place, but could procure no food from the Indians, the bad " weather having so swollen the rivers, as to prevent their fishing. " I boiled the last of my rice for supper, which gave but a scanty " meal, and resuming my march, the next day, proceeded pretty " well till, reaching the wooded top of the lofty river bank, my " jaded horse stumbled and rolling down, descended the whole " depth over dead wood, and large stones, and would infal- " libly have been dashed to pieces in the river below, had he not " been arrested by getting himself wedged fast between two large " trees that were lying across one another near the bottom. I " hurried down after him, and tying his legs and head close down " to prevent his struggling, cut with my hatchet through one of " the trees, and set the poor beast at liberty. I felt a great deal " on this occasion, as the horse had been Mr McLoughlin's pres- " ent to me, and was his own favourite animal. Reached the camp " at dusk, where I found only Michel La Framboise, our Chenook " interpreter, and an Indian boy, who told me that the savages " had been very troublesome ever since our brigade of hunters " left him some days before. The former kindly assisted me " to pitch my tent, and gave me some weak spirits and water, with " a basin of tea, made from a little that he had brought from Fort " Vancouver, and which greatly refreshed me."

Soon after this, messengers having to be dispatched to Fort Vancouver, Mr. Douglas took advantage of the opportunity and accompanied them homewards. After twelve days travelling under the disadvantage of hunger cold and rain, he reached Fort Vancouver, on the 20th of November, although, not without losing the greater part of his collection in crossing the river Sandiam, a tributary of the Willamette, then swollen with rain. Fortunately, with other rarities, the pine cones were saved.

It was at this period I had the pleasure of making the acquaintance of Mr. Douglas. Having crossed the Columbia, I arrived in this month of November at head quarters, and soon found the man of science to be one of the heartiest, happiest mortals in our little society. He now received letters from England, consolotary to him in every respect, and the sense of inward satisfaction, as well as the bright gleams cast on his spirit, by the cheering words of those he loved and respected in his native country, brought out in full glow the warm effusions of a pure and honest heart.

The Spring of 1827 was severe, and much snow had fallen. The consequence was that many horses died at Fort Vancouver, and we were visited by the various species of beasts and birds of prey that abound in that country. Most conspicuous among these were the California vulture. This magnate of the air was ever hovering around, wheeling in successive circles for a time, then changing the wing as if wishing to describe the figure 8; the ends of the pinions, when near enough to be seen, having a bend waving upwards, all his movements, whether of soaring or floating ascending or descending, were lines of beauty. In flight he is the most majestic bird I have seen. One morning a large specimen was brought into our square, and we had all a hearty laugh at the eagerness with which the Botanist pounced upon it. In a very short time he had it almost in his embraces fathoming its stretch of wings, which not being able to compass, a measure was brought, and he found it full nine feet from tip to tip. This satisfied him, and the bird was carefully transferred to his studio for the purpose of being stuffed. In all that pertained to nature and science he was a perfect enthusiast. It has been frequently matter of surprise how quickly these birds collect when a large animal dies. None may be seen in any direction, but in a few minutes after a horse or other large animal gives up the ghost they may be descried like specks in the æther, nearing by circles to the prey, when as yet one would not suppose the effluvia from the carcase had reached above a hundred yards. This renders it probable that their sight as well as sense of smelling is very acute, bnt that the latter can guide them entirely without aid from the other, I am certain, as I have started them from carrion within the edge of a forest under bushes which must have precluded the possibility of their seeing the carcase before they alighted on it.

March of 1827 arrived, and we were obliged to part with our agreeable companion. On the 20th of that month he left us to proceed to England by traversing the Rocky mountains in Lat. 54° in company with the Hudson's Bay party, which was accustomed to cross annually to York factory with Spring despatches.

(*To be Continued.*)

REVIEWS AND NOTICES OF BOOKS.

The Life, Travels, and Books of Alexander von Humboldt. With an introduction by Bayard Taylor. New York, Rudd & Carleton; Montreal, B. Dawson & Son, pp. 482.

This is a very able and interesting account of the life and labours of Humboldt. The author's signature is R. H. S., why the full name is concealed, we cannot tell. The task undertaken by him or her, is ably executed. Those who wish to know what Humboldt did, and the foundation upon which his great fame rests, will find the information desired in this volume. It does not profess to be a biography of the great naturalist and philosopher, but it is a sketch taken from the most authentic sources of the course of his life, from the cradle to the grave. It tells us how and where his youth was spent, at what universities he studied, who were his teachers, what his favorite pursuits, his early employments and thirst for foreign travel. A brief notice is given of his travels and researches, in company with the botanist Bonpland, in the regions of South America, during the early part of the nineteenth century. It traces the course of Humboldt's travels through Russia to the Ural Mountains, and through northern Asia to the mines of the Altai. Finally, the author gives a brief account of the character and cost of the great works prepared and edited by Humboldt; and concludes with agreeable notices of his last days. The name of Humboldt has become a household word in Europe and America. He is everywhere known and acknowledged to be the prince of Modern Science. For those who have not much leisure to peruse the works and to make themselves familiar with the scientific researches of the late Baron von Humboldt, we would recommend the perusal of this volume. It is agreeably written, and is worthy of a place in the study or the family library. A. F. K.

A first lesson in Natural History. By Actœa. (Mrs. Agassiz.) Boston, Little, Brown, & Co. Montreal, B. Dawson & Son. *Illustrated*. pp. 82.

This little book has been prepared by its amiable and accomplished Authoress in the hope that it may be interesting to

children. Its aim is to make them acquainted with some of the curious aud wonderful forms of animal life which are to be found on the sea-shore. Having been revised by Agassiz himself, there is the best guarantee that its facts may be implicitly relied upon. Children may, therefore, be assured that strange as these stories are, they are all perfectly true. The four chapters into which the book is divided treat in succession most pleasantly of sea-Anemones and Corals; Coral Reefs; Hydroids and Jelly-fishes; Star-fishes and Sea Urchins. They are addressed in the form of stories to two children, and are so plain aud clear, and yet elegant in their language, that they may easily be understood and appreciated by very young persons. We are sure that this will be a favourite childrens book. Although intended for the young, it may yet be read with profit by fathers and mothers. It is beautifully printed and the illustrations are good. We trust that the authoress may be induced to continue these stories, as they seem to us well-fitted to turn the attention of the young from frivolous and hurtful tales to the healthy and delightful pursuit of Natural Science. A. F. K.

A Manual of Scientific and Practical Agriculture for the School and the Farm. By J. L. Campbell, A.M., Professor of Phys. Science, Washington College, Va., with numerous illustrations. pp. 442. Philadelphia, Lindsay & Blakiston. Montreal, B. Dawson & Son.

This book has been written to supply the rapidly increasing demand for scientific information applicable to the daily business of agriculture. The chief purpose kept in view in its several chapters has been the preparation of a Manual which might serve as a guide to the young in the acquisition of the sciences pertainining to agriculture. None of the systematic books hitherto published on this subject were adapted to the necessities of the Southern and Western States of America. This unoccupied place the present publication is intended to fill. The plan is both simple and complete. It embraces in well digested and clearly expressed paragraphs all the subjects which pertain to the science of farming. The first chapter contains definitions and illustrations of terms, and the twenty-five following embrace the leading facts and principles of chemistry, geology, vegetable physiology, practical treatment of all kinds of soils, and the various cereals, roots

and plants, with which farming on this continent is conversant. The history and property of manures, and the application of fertilizers is carefully treated. The planting and culture of corn, wheat, oats, potatoes, hay, beans and peas, tobacco and cotton, are the topics of successive chapters. And finally root-crops, together with the leading facts of animal physiology, and the selection and care of stock, receive careful attention. The Appendix contains a list of chemicals and apparatus, with tables of money and weights and measures. The wood-cut illustrations are worthy of all praise. The style is highly finished, clear, and forcible. We regard this book as one of a high order of excelelnce, and which might with advantage be in the hands of the young farmers of Canada. A. F. K.

The British Tortrices. By S. J. Wilkinson. (Van Voorst.)—The great barrier to an exhaustive study of the animals of the British Islands is its insects. Hence we find naturalists who are tolerably conversant with our Vertebrate animals, our Mollusca and Radiata, who scarcely know a single insect. On the other hand, the naturalist who ventures on the insect kingdom is irredeemably committed to its study. A lifetime is quite insufficient to get through its various groups. He begins with the beetles, and there he sticks: he does not even become an entomologist; he is the student of a group, and is dubbed a coleopterist. Thus we have works devoted to his use, and a 'Coleopterist's Manual' to guide him in his studies. If he takes up butterflies and moths, the same affluence obstructs his progress. He becomes a lepidopterist, or a micro-lepidopterist; and only by this exclusive attention to a branch can he expect to aid in the development of the science of Entomology. The same is true of the other great groups of insects, of Diptera, Hymenoptera, Neuroptera, and the rest. Thus it is that the reputation of men who have spent a lifetime in the study of animal habits and forms, and made for themselves an undying fame, is scarcely known to the public at all. The amount of accurate observation, logical generalization, and scientific thought, expended on insects alone, is probably as great as that in all other departments of Zoology. Although its practical value may be thought less, it is, nevertheless, in this group of animals that some of the great laws of animal morpho-

logy have been most successfully worked out, whilst the hosts of those little creatures that dwell in our forests, live in our fields become the pests of our houses, our beds, and our food, give a practical value to the knowledge of their habits, which cannot be claimed by animals of greater size, and which are more easily observed. The work before us is an illustration of the generally unappreciated labours of the entomologist. There is a little group of moths whose caterpillars swarm in our gardens, attack our beans and peas, and twist themselves curious homes in the leaves of our limes, laburnams, and other trees. These are the larvæ of the "British Tortrices." Many of them have been figured and named, but no complete work descriptive of them existed, and Mr. Wilkinson has in this volume supplied the want. He has described, with great accuracy, from original specimens, three hundred species of these insects. As this has been done with the skill of a master, the work must take its place beside the great descriptive works devoted to other families of insects. To the reading public such a work presents no attractions. In passing from page to page it looks like a wearisome repetition of nearly the same forms; but let no one despise who cannot understand, for in these descriptions lies the very soul of zoological science. Without an accurate apprehension of individual forms, there could be no general law of form, and the great science of Morphology would cease to advance. Every now and then, however, amid the dreary waste of description, we get a pleasant peep into the entomologist's way of life. We find his favorite caterpillars feeding on the ferns of Wimbledon Common, the oaks of New Forest, the hawthorns of Epping Forest, the birches of the banks of Dee, or the heather of Scotch mountains. These "habitats" are suggestive of pleasant rambles amongst the forests, rivers and mountains of our island; and we cannot but feel that such pursuits must have an invigorating influence on the mind and body, in addition to their importance in contributing to the advancement of human knowledge.—*Athenæum.*

The Rudiments of Botany, Structural and Physiological. By Christopher Dresser. (Virtue.)—This very modest title introduces in many respects one of the most complete works on structural botany in our language. Mr. Dresser is Lecturer on

Botany, and Master of the Botanical Drawing Classes in the Department of Science and Art of the Privy Council for Education. In this capacity he has felt the want of more copious illustrations than ordinary botanical manuals supply. He has accordingly endeavoured to supply this want, and has produced a work which, for completeness and beauty of illustration, has certainly no rival. The work is more particularly devoted to structure, and the physiological remarks are everywhere only secondary and incidental. It is written in the form of simple propositions easily comprehended by the student, and every detail of the structure of plants is copiously illustrated by original drawings, or by woodcuts from works of acknowledged excellence. As the work is written for Art students, it has been evidently the object of the author to divest his illustrations of the mere diagrammatic form which they assume in most works on botany, and in this, we think, he has to a large extent succeeded. To say that all the drawings are of equal excellence would be doing injustice to those which are executed with great truth and excellence; but the work, as a whole, stands alone in point of illustration, and must henceforth be the text-book of Art students. We strongly recommend this book to artists, as the want of a knowledge of the real structure of plants is an acknowledged desideratum in the productions of many of our first artists. If they attended more to the laws of plant-life, we should not see their paintings so often disfigured by monstrous and impossible plants. They would learn here that the general effect of particular groups of plants is produced by their special forms, and that nothing but a knowledge of these forms can enable them to give a true expression to the wonderful variety of foliage to be formed in nature.—*Athenæum.*

Professor Hall's Report on the Geology of Iowa. Vol. I. Parts 1 & 2.

We should have noticed some time since these elegant volumes, admirably illustrated, and replete with the results of the application of Prof. Hall's talent and matured skill to the new regions of the west. Iowa is a rectangle of 300 miles by 200, its north line being the parallel of 43° 30′, and its eastern and western boundaries the two great rivers of the west, the Mississippi and Missouri. It is nearly level and consists principally of prairie land with belts of timber in the river valleys.

The greater part of the State rests on the palæozoic formations, the whole of which from the Permian to the Lower Silurian inclusive are represented. The points of difference between these formations in Iowa and in the Eastern States and British America are such as the following. The Permian system, wanting in the East, makes its appearance in Iowa and the neighbouring region of Kansas where it was first recognised. The coal measures thin out, while the carboniferous limestone, largely developed in Nova Scotia, but nearly absent in the region of the Appalachians, re-appears in great force in the west, and with very remarkable differences in its fauna. The various members of the Devonian and Silurian systems are represented, but with the exception of the Niagara limestone and Potsdam sandstone, with diminished thickness. The only formation newer than the Permian as yet recognized in Iowa, is the Cretaceous which has not as yet been fully examined.

All there formations are spread out in an undisturbed and slighly inclined position, and their principal useful minerals are coal, galena, and gypsum. The coal measures have an aggregate thickness of only about 100 feet, and appear to include only two beds of coal, the most important of which sometimes attains a thickness of four feet. The coal seams are by no means regular, but have probably been affected in their original deposition by many local disturbances ; a remark which applies to these old fossilized bogs much more generally than persons who have not studied the coal measures in detail are aware of. The coal of Iowa is bituminous, and of various qualities in reference to the quantity of earthy matter contained in it.

The lead region of Iowa is a continuation of that of Upper Missouri. The mineral occurs in vertical fissures widening into large cavities or caverns, filled with clay and ore, or with compact ore, and sometimes communicating with flat tabular expansions or beds. These deposits occur principally in the "Galena Limestone," but are also found in diminished extent in the Trenton limestone which immediately underlies it. They appear to be quite wanting in the overlying formations.

The Gypsum occurs in rocks probably of Permian age, but their detailed examination is not included in this portion of the report.

The second part is devoted entirely to the fossil remains of the

Devonian and Carboniferous rocks, and a great many new species are described. The fossil plants are not noticed.

Professor Hall has been assisted in the survey by Mr. Worthen and Mr. Whitney; the latter of whom acts as chemist and mineralogist to the survey. J. W. D.

CORRESPONDENCE.

Extract of a letter to the Editors of the CANADIAN NATURALIST from MR. D. W. BEADLE, dated St. Catherines, C. W., February 23, 1860.

Believing that the larva of *Argynnis Aphrodite* has never been described I send you the following description.

I found the larvæ as early as the 8th. of June 1859, of nearly all sizes from a few days old up to the full grown specimen. They feed on plants of the genus *Viola* indiscriminately, not hesitating in confinement to use our gadren varieties when the native species are not supplied.

The full grown larva is an inch and a quarter in length, of a black color and ornamented with parallel rows of black spines, set with minute branches. The head is bi-mucronate, black anteriorly, posteriorly reddish-brown. The second segment has two dorsal spines that are entirely black, the other spines have all a reddish-brown base and are arranged as follows: between the second and third segments are two lateral spines, (one on each side,) on the third segment are two dorsal spines, between the third and fourth two lateral and on the fourth two dorsal spines; the fifth to the twelfth segments both inclusive, have six spines, between the twelfth and thirteenth segments are two dorsal spines, and on the thirteenth two lateral. The spines are so arranged as to form rows both lengthwise and across. The underside of the larva is a little lighter colored than the upper, and the legs are the same color as the underside. The prolegs are black.

The chrysalis is brown, in shape much like that of *Vanessa Antiopa*, suspended, and without any gilded spots.

MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

MEETINGS OF SECTIONS.

A.—MATHEMATICAL AND PHYSICAL SCIENCE.

President.—The Earl of ROSSE, F. R. S., &c.

This Section met in a class-room of Marischal College, which was quite crowded. His Royal Highness the Prince Consort, in visiting the Sections, entered this room a few minutes after eleven. His entrance was received with loud cheers, the audience rising to their feet. He took his seat on the left of the President.

Lord Rosse then said:—Ladies and Gentlemen,—It has recently been usual at opening the proceedings, to give, as far as may be practicable, a general outline of the business to be brought before the Section, and some kind of notice of the order in which it is likely to be taken. As, however, many papers usually come in after the meeting of the Section, and as circumstances often arise rendering it necessary to alter the order of proceeding, any notice which can be given must necessarily be very imperfect. The daily notice will, however, in some degree, remove the difficulty. It has also, I believe, been usual to give some slight account of the general character of the business to be transacted, so that new members may be enabled better to decide whether to attend this Section or some other. I have just looked over the papers that have been sent in. I find that there are papers on pure mathematics and on applied mathematics: papers more especially on light and electricity; on magnetism, on meteorology, and on the construction of mathematical instruments. Also, papers in several other minor departments of physics. But, up to the present time, there are some branches of science in this Section in which the papers have not been given in and are yet to come. However, by this account you will be enabled to form some idea of the character of the business to be transacted. Now first, with respect to the mathematical papers, I need perhaps hardly say that essays on so abstruse a subject, can scarcely be of very much general interest; they can scarcely be of interest except to mathematicians. And the subject of mathematics is so extensive, that even they—unless the papers happen to be on branches related to those

they have specially studied—may sometimes be unable to do more than trace the leading principle and general s ope of the papers. However, without any special mathematical knowledge, a well informed man may, often in the results announced, and I may add from the observations elicited, obtain very interesting glimpses of the nature of mathematical processes and some general idea as to the progress making in that direction. In applied mathematics there is much more of general interest, and the results are often perfectly intelligible without special education. I recollect that at the meeting of the British Association at Oxford, the general results of a very abstruse investigation in applied mathematics in physical astronomy were made very interesting. The subject was so brought forward as to rivet the attention of the whole section, and there were many ladies present. The paper was given in by M. Leverrier, and the subject was the identification of a comet. Discoveries in electricity, light, heat, and magnetism, cannot fail to be of great general interest. To the human mind nothing is so fascinating as progress. It is not what we have long had that we most prize. We highly prize new accessions, but we enjoy almost unconsciously gifts of far more value, we have long been in possession of. This is our nature; thus we are constituted. It is not surprising, therefore, that we should have a peculiar relish for new discoveries. (Applause.) The interest of discovery, however, is not permanent. For a time we are dazzled by its brilliancy, but gradually the impression fades away, and at last is lost entirely in the splendour of some fresh discovery which carries with it the charm of novelty. When we reflect upon this we cannot help perceiving in how very different a state the world would be from what it is if mankind in the beginning had been in the possession of all the knowledge we now have, and there had been no progress ever since. We naturally ask why were all those objects which have been laid before us so hidden—veiled—only to be brought to light by the vigorous use of our faculties? How wonderful from its origin has been the progress of mathematical science. Beginning perhaps 3000 years ago almost from nothing —one simple relation from magnitude suggesting another, and those relations gradually becoming more complicated, more interesting, I may add more important, till at length in our day it has expanded into a Science which enables us to weigh the planets, and more wonderful still, to calculate the course they will

take when acted continually upon by forces varying in magnitude and direction. When we ask ourselves such questions as these naturally suggest and thoughtfully work out the answers as far as we can do to their full depth, we become in some degree conscious of the immense moral benefits which the human race has derived from the gradual progress of knowledge. The discoveries, however, in Physical Science are ever giving man new powers, enabling him to supply his many wants. I am sure the mention of the subject has suggested to you some of the wonderful discoveries of later times. For instance, the production of force and power, almost without limit, by heat, and its application to locomotion by land and water, the transmission of thought not slowly by letter, not short distances by sound, but to immense distances and instantaneously by electricity. When we look around and see how man has appropriated to his use the properties of light, of heat, the powers of wind and water, the materials which have been placed before him in endless variety on the surface of the globe which he inhabits, that he has effected all this by knowledge accumulated by what we call science, it is surely not surprising that we should look upon discoveries in applied science with surpassing interest. The mere utilitarian, however, has been often reminded that discoveries the most important, and most fruitful in practical results have frequently in the beginning been apparently the most barren, and therefore that the discoveries of abstract science are not without interest even for him. I confess, however, that the gradual development of scientific discoveries; in fact, in other words, the steady flow of knowledge into the world—which like a stream as it proceeds increasing in depth and breadth, points to its own source, its own origin, which is the origin of man.—I confess that these powers appear to me to serve far more noble purposes than merely ministering to the corporeal wants of man, as they increase, or are supposed to increase, with the progress of civilization. (Applause). What those purposes are, I think, to some extent, we can clearly see, though to fathom the full depths of such an inquiry, would be beyond our powers. Looking merely on the surface, we perceive that the continual springing up of new facts, new discoveries, in endless procession, the rewards of industry must tend to make man industrious, to inspire him with hope, quicken his faculties, and entice him to labour—to labour with his mind—the hardest of all labour. It forces him to look behind

and before, to the past and to the future, and it promotes in him a moral training by the influence it exercises over his thoughts and habits. (Cheers). Many, no doubt, will feel anxious to see principles immediately applied to practice; in common language, to see principles made useful. They, I have no doubt, will be highly gratified in the Mechanical Section. Here they may, perhaps, occasionally see the same thing; but more frequently they will find that the results are but stepping stones, which prepare the way for further progress—(Applause).

B—CHEMICAL SCIENCE.

President.—Dr Lyon Playfair, C. B.; F. R. S.

ADDRESS OF DR. LYON PLAYFAIR, F. R. S.

This section was quite crowded. Precisely at half-past 11 o'clock, Dr. Lyon Playfair took the chair, and intimated that the section would not open until the arrival of H. R. H. the Prince Consort. At 12 o'clock Prince Albert arrived, and was received by the company standing. Immediately on the Prince being seated, the President began to read his opening address. Its chief topic was the combining proportions of the elements of bodies, and was as follows:—

My predecessor in this chair, Sir John Herschel, drew our attention to the great importance of studying with increased accuracy, the combining proportions of bodies in the hope of determining the exact numerical relations which prevail between the elements. He justly regarded it as a subject worthy of the most accurate experiment, to ascertain whether the combining proportion of the elements or multiples of the combining of Hydrogen, be as suggested by Prout, cautioning chemists at the sametime not to accept mere approximative accordances as evidence of this relation.

I have now to congratulate the Section on the publication of the laborious investigations of Dumas on this important enquiry. It required a chemist of great manipulative skill as well as of fertile experiment, to obtain combining numbers for the elements upon which a greater reliance could be placed, than upon those determined with such admirable precision by Berzelius that great master of analysis. The atomic weights found by that chemist did not, for many of the simple bodies, confirm the suggestion of Prout

as to the multiple relations of these numbers to the equivalent of hydrogen. At the same time, the more recent determinations for the atomic weights of carbon, silver, and some other elements, so closely coincided with this view, that it was very desirable to extend new experiments to the bodies which had fractional atomic weights assigned to them.

In M. Dumas' Memoirs there are the results, though not the details, of a large series of experiments, on many of the elements. He obtained numbers of precisely the same value as that by the method of the Swedish philosopher—numbers which are not the multiple of the equivalent of hydrogen. But when he pursued his experiments upon these same elements, with the methods of discovery and his own inventiveness, then atomic weights were obtained which corrected themselves from the error inherent in former methods of analysis, and resulted in being multiples of the combining proportions of hydrogen, or in standing in a very simple relation to that number. There is on this point evidence so clear that there is scarcely a chance of deception. The labours of Dumas, Pierre, Peligot, and others, have established the relation by recent determinations of clorine, iodine, bromine, silver, titanium. &c. Elements differing so much in chemical character as well as in atomic weight, that it is difficult to conceive any fortuitous combinations which could have produced such uniformities in the results of analysis. Hence the general view of Prout, that the equivalents of the elements, compared with certain unities, are represented by whole numbers, seems to be established by recent experiment, although it would be premature to declare that there are no exceptions to the law.

In this country we are familiar with many ingenious discussions on the natural grouping of the elements, and the relations of their equivalent numbers to each other. I allude to the paper of Gladstone, Odeling, and Mercer, and to the views of Cork, in America. Altho' these efforts point to important dependencies of the elements on each other, yet we cannot adopt them as parts of our scientific system. Another question of a different character, as regards equivalents, has recently received attention. I refer to the proposal, to double the equivalents of Carbon and Oxygen, that is to raise them from 6, and 8, to 10, and 16 respectively. As these two elements are essentially connected with the whole system of chemistry, the right determination of their equivalents is a matter of extreme importance.

Undoubtedly there are cogent reasons which induce many of our able chemists to double the equivalents of carbon and oxygen, and they are well worthy of the calm and deliberate consideration of a meeting like this. Such an alteration would produce an immense change on the literature of the science, and should only be adopted if the benefit to be derived from it is proved to be so great as to justify the inconvenience. This subject will be brought before the Section on more than one occasion. The change proposed has, in a great measure resulted from the new views of the classification of organic compounds introduced by Gerhardt. The recent brilliant progress in organic chemistry has resulted in the discovery of a vast number of new compounds. A scheme of classification became urgently necessary for them, and the genius of that great French Chemist produced a system which has exerted a most important influence on the advancement of science. The comprehensive system planted by Gerhardt has been carefully watered and tended by our countrymen, Williamson, Hunt, Odeling, and Brodie—watered until the young plant has attained a most vigorous growth. In a report upon the state of organic chemistry, by one of these gentlemen, we shall have the advantage of tracing its effect on the advance of science. Another of our members who admires the beauty of the plant, and the excellence of the fruit it has borne, fears that it is growing too wildly, and that the pruning knife might be adopted with advantage. He, therefore, proposes for our consideration in a paper which will be laid before you some modifications of the system of classifying compounds now so prevalent. With the array of talent in our sections, enlisted in favour of Gerhardt's system, there will be full justice rendered to the merits of that lamented philosopher in any discussion which may follow the reading of the paper to which I allude. In conclusion, I have to congratulate the meeting upon the important muster of English Chemists in our Section; although we have at the same time to regret that our cold northern position has prevented our foreign colleagues from joining us and enjoying that welcome which the warm hearts of our countrymen would assuredly have accorded to them.—*Cited from the London Athenæum.*

MISCELLANEOUS.

Abstract of the proceedings of the Geological Society of Loadon.

Session 1859–60.

December, 14, 1859.—Prof. J. Phillips, President, in the Chair.

The following communication among others was read:—

"On a Terrestrial Mollusc, a Chilognathous Myriapod, and some new species of Reptiles, from the Coal-formation of Nova Scotia." By J. W. Dawson, LL.D., F.G.S. &c.

On revisiting the South Joggins in the past summer, Dr. Dawson had the opportunity of examining the interior of another erect tree in the same bed which had afforded the fossil stump from which the remains of *Dendrerpeton Acadianum* and other terrestrial animals were obtained in 1851 by Sir C. Lyell and himself. This second trunk was pointed out to him by Mr. Boggs, the Superintendent of the Mine. It was about 15 inches in diameter, and was much more richly stored with animal remains than that previously met with. There were here numerous specimens of the land-shell found in the tree previously discovered in this bed,—several individuals of an articulated animal, probably a Myriapod,—portions of two skeletons of *Dendrerpeton*,—and seven small skeletons belonging to another Reptilian genus, and probably to three species.

The bottom of the trunk was floored with a thin layer of carbonized bark. On this was a bed of fragments of mineral charcoal (having Sigillaroid cell-structure), an inch thick, with a few Reptilian bones and a *Sternbergia*-cast. Above this, the trunk was occupied, to a height of about 6 inches, with a hard black laminated material, consisting of fine sand and carbonized vegetable matter, cemented by carbonate of lime. In this occurred most of the animal remains, with coprolites, and with leaves of *Noeggerathia* (*Poacites*), *Carpolithes*, and *Calamites*, also many small pieces of mineral charcoal showing the structures of *Lepidodendron*, *Stigmaria*, and the leaf-stalks of Ferns. The upper

part of this carbonaceous mass alternated with fine grey sandstone, which filled the remainder of the trunk as far as seen. The author remarked that this tree, like other erect *Sigillariæ* in this section, became hollow by decay, after having been more or less buried in sediment; but that, unlike most others, it remained hollow for some time in the soil of a forest, receiving small quantities of earthy and vegetable matter, falling into it, or washed in by rains. In this state it was probably a place of residence for the snails and myriapods and a trap and tomb for the reptiles; though the presence of coprolitic matter would seem to show that in some instances at least the latter could exist for a time in their underground prison. The occurrence of so many skeletons, with a hundred or more specimens of land-snails and myriapods, in a cylinder only 15 inches in diameter, proves that these creatures were by no means rare in the coal-forests; and the conditions of the tree with its air-breathing inhabitants imply that the Sigillarian forests were not so low and wet as we are apt to imagine.

The little land shell, specimens of which with the mouth entire have now occurred to the author, is named by him *Pupa vetusta.* Dr. Dawson has found entire shells of *Physa heterostropha* in the stomach of *Menobranchus lateralis*, and hence he supposes that the *Pupæ* may have been the food of the little reptiles the remains of which are associated with them.

Two examples of *Spirorbis carbonarius* also occurred; these may have been drifted into the hollow trunk whilst they were adherent to vegetable fragments. The Myriapod is named *Xylobius Sigillariæ*, and regarded as being allied to *Iulus.*

The reptilian bones, scutes, and teeth referable to *Dendrerpeton Acadianum* bear out the supposition of its Labyrinthodont affinities. Those of the new genus, *Hylonomus*, established by Dr. Dawson on the other reptilian remains, indicate a type remote from *Archegosaurus* and *Labyrinthodon*, but in many respects approaching the Lacertians. The three species determined by the author are named by him *H. Lyellii*, *H. aciedentatus*, and *H. Wymani.*

Distribution of Forests in North America.—(The subject of geographical botany is now exciting much attention, and very deservedly, for independently of its interest in itself, it is capable of throwing much light on the vexed questions of the nature and

origin of species, and on the changes of climate which the earth has experienced in past periods. The Smithsonian Institution has just issued a very interesting pamphlet on this subject relating to the Trees of North America, from which we make the following extracts. The first relates to the mode of collecting specimens for purposes of accurate comparison.)

" Collections of the leaves, fruits, bark, and wood of our native trees are particularly desirable, and from as many localities as possible, in order to determine both their range and abundance, and also to decide those knotty points as to true specific distinctions, which still perplex the most skilful botanists. The specimens from each tree should be kept carefully together, and the name of the locality and collector given in full. Without such collections no information as to the large genera of oaks, hickories, magnolias, and, in fact, most others, can be at all depended on or made use of. Collections from the extreme corners of the United States, and from any part of the western mountains, will be particularly useful in determining all these questions. A good way of preserving a complete set from each species of tree is to obtain two pieces of the thick bark of the trunk about a foot square, *taking care not to rub off the mosses or lichens*, which are often very characteristic of the tree. Other specimens of bark from the branches, sufficient to show all its changes in appearance, and twigs with leaves, flowers and fruits, may be pressed between the trunk bark, with sufficient paper of any kind intervening, to absorb all moisture. One change of this paper will usually be sufficient, (especially if the bark is dry;) and fruits, if large and hard, may be so fixed as to hang outside, wrapped in paper. Particular care is necessary to prevent mixture of specimens. Blocks of wood from the trunk and branches at various seasons are also desirable for experimenting upon.

Observations as to the relative abundance of each tree at the various stations may be expressed numerically, thus: very rare, 1; occasionally met with, 2; not uncommon, 3; common, 4; very common, 5; abundant, 6, &c.; using numbers up to 10, and explaining them. Frequently several trees will be found so nearly alike in abundance as to require the same number. Notice should also be made of the nature of the country and soil—whether mountainous, rocky, gravelly, sandy, or swampy, which will help to determine the limits of the natural regions. The geological structure of the district is, however, of secondary importance.

The columns of range may be used by observers filling the blanks or adding to the recorded range in either direction; but this must be done carefully and with a perfect knowledge of the species noted. The name of the county should be given as well as of the town, and is preferable if only one is stated. Such blanks, filled up, may be cut out and sent to the Smithsonian Institution, addressed to the Commissioner of Patents, with the writer's name. Meteorological observers will take a special interest in the subject, and in most cases can make the best notes from their habit of observing the connexions of peculiarity of climate and forest growth."

A second extract is furnished by the general conclusions as to the causes of the peculiar characteristics of the "Campestrian" region of the western prairies:

"Now coming to the CAMPESTRIAN PROVINCE we find, as already stated, that no new forms of trees appear, while those found rapidly diminish and disappear towards the west. Thirteen species have not been traced west of its eastern border; about ninety extend pretty far into the *Texan* and *Illinois* regions, but only five or six get across the eastern limit of the Camanche and Dacotah regions, which, however, receive nine or ten more from the west and north.

The *Saskatchewan* region, bordering close upon the well-wooded Lacustrian Province, may have a few more eastern species, and possibly more from the west, as there is evidence that it is better watered and approaches in character to the Illinois region.

It will be observed that the southeast and northeast borders of this province form nearly a right angle with each other, and extending east into Michigan cause a wide separation of the Lacustrian and Apalachian provinces. This is one of the most well defined facts in the distribution of trees. A careful examination of the minute land office surveys has shown that the line is exceedingly distinct in Wisconsin and Minnesota, prairies prevailing to the south of it interspersed with oak-openings and groves of deciduous trees along the streams, while to the north pine and spruce forests with tamarack swamps cover the whole country, having the other *Canadian* trees with them. This is doubtless in great part due to the change in the character of soil and of the underlying rocks, which retain the moisture, while it is completely drained off to the south. Thus we have here a distinct division of the two eastern forest

provinces, assisting to determine where it would be eastward were it not disguised by local irregularities of surface.

The cause of the disappearance of trees in the Campestrian Province is, in a word, the deficient and irregular supply of moisture. I need not enter into the proofs of this, but refer to the records of meteorologists. It is true that this does not materially affect agriculture in the more eastern regions; in fact, most crops will succeed better with less rain than is necessary for most trees to thrive, and in some years there is even a greater supply of rain in the Texan and Illinois regions than eastward. But there are years and series of years of drought, when in their natural condition the forests take fire from the slightest cause and burn over large tracts. This was made even more general by the Indians but since the white settlement has in great degree ceased and forests have been re-established. In the Apalachian region droughts have never been sufficient to keep trees from extending themselves as soon as a forest might be partially destroyed by fire, and thus the formation of prairies has been prevented. A consideration of the source of the rains will explain why the limit of prairies has its present direction. Coming north from the Gulf they are continually carried more and more eastward by the westerly winds; and as the greater part of the moisture is precipitated before reaching the Ohio river, the Illinois region is deprived *for many* years of its due share of rains.

The Texan region lying quite west of the line of travel of those Gulf streams has to depend on less abundant sources for its rains. Now, as we go westward the supply rapidly diminishes until in the Camanche and Dacotah regions it is entirely inadequate to the growth of trees as well as of most cultivated products; and in some parts even grass and other herbage entirely disappear over vast tracts. From the great bend of the Missouri north, however, there seems to be an improvement in the country. On the banks of that river, above Fort Union, there is no long interval without trees as there is farther south on nearly all the streams, and on the Saskatchewan there is even less.

The very porous character of the soil and underlying rocks assists much in this aridity of the country, and we therefore find that the line marking the junction of the carboniferous rocks of the Illinois region with the cretaceous and tertiary is a distinct limitation of many trees.

When better known the geological character will help much in defining the physical geography of the surface of this province. In Texas the border of the Llano Estacado coincides with that of the Camanche region for a long distance. It is evidently more the retentiveness of the soil than its mineral composition that affects the growth of trees, for all soils contain more or less of their essential ingredients.

Even the saline substances, which are supposed by some to make deserts of portions of the Great Plains, are rather the secondary effects of the climate; for if rains were abundant these salts would become diffused, and in their proper proportions enter into the structure of trees and other plants."

Catalogue of Coleoptera collected by George Barnston, Esq., of the Hon. Hudson's Bay Company, in the Hudson's Bay Territories.

Dr. Leconte having expressed a wish to examine any Coleoptera from the Hudson's Bay Company's Territories which could be obtained in Montreal, Mr. G. Barnston most obligingly placed his collection in my hands for transmission to Philadelphia; and as Dr. Leconte has kindly furnished me with a list of the species, I have drawn up the following catalogue of them for publication in the "Canadian Naturalist." W. S. D'U.

Montreal, June 2nd, 1859.

COLEOPTERA.

Cincidela longilabris, *Say*. North end of Lake Winnipeg.
" duodecim-guttata, *Dej*. " " "
" hirticollis, *Say*. " " "
Cymnidis reflexa, *Lec*. Locality not recorded.
Calathus confusus, *Lec*. Carlton House.
Platynus erythropus, *Kirby*. (obcordatus, *Lec*.) Lat. 54° N., long. of Lake Winnipeg.
" obsoletus, *Lec*. North end of Lake Winnipeg, and lat. 54° N.
" sinuatus, *Dej*. " " "
" (*not determined.*) " " "
Pterostichus orinomum, *Leach*. Carlton House; north end of Lake Winnipeg; and lat. 54° N., long. of Lake Winnipeg.
" punctatissimus, *Randall*. Carlton House.
Amara confusa, *Lec*. Lat. 54° N., long. of Lake Winnipeg.
" fallax, *Lec*. North end of Lake Winnipeg, and lat. 54° N.

Amara lacustris, *Lec.* North end of Lake Winnipeg, and lat. 54° N.
" interstitialis, *Lec.* Carlton House, and north end of Lake Winnipeg.
" " Var. North end of Lake Winnipeg.
" carinata, *Lec.* Mackenzie River and Great Slave Lake.
" obesa, *Say.* Locality not recorded.
Agonoderus pallipes, *Fabr.* " "
Harpalus amputatus, *Say.* Carlton House.
" pleuriticus, *Kirby.* North end of Lake Winnipeg, and lat. 54° N.
Chlænius niger, *Randall.* North end of Lake Winnipeg.
Carabus serratus, *Say.* " " "
" Agassii, *Lec.* " " "
" Lapilayi, *Lap.* " " " and lat. 54 N.
Nebria Mannerheimii, *Fisch.* Carlton House.
Elaphrus Californicus, *Maun.* var. punctatissimus, *Lec.* Mackenzie River and Great Slave Lake.
Bembidium impressum, *Fabr.* North end of Lake Winnipeg.
" transversale, *Dej.* " " " and lat. 54° N.
Dytiscus confluens, *Say.* Lat. 54° N., long. of Lake Winnipeg.
" Harrisii, *Kirby.* " " "
Helophorus lineatus, *Say.* North end of Lake Winnipeg.
Necrophorus pygmæus, *Kirby.* Lat. 54° N., long. of Lake Winnipeg.
Silpha lapponica, *Herbst.* Carlton House; north end of Lake Win nipeg; and lat. 54° N.
" trituberculata, *Kirby.* North end of Lake Winnipeg.
Staphylinus villosus, *Grav.* North end of Lake Winnipeg, and lat 54° N.
Hister depurator, *Say.* " " " " "
Pediacus planus, *Lec.* Lat. 54° N., long. of Lake Winnipeg.
Dermestes lardarius, *Linn.* North end of Lake Winnipeg.
Attagenus megatoma, *Fabr.* Mackenzie River and Great Slave Lake.
Byrrhus Americanus, *Lec.* North end of Lake Winnipeg.
Cytilus varius, *Fabr.* " " " "
Platycerus depressus, *Lec.* " " " "
Lachnosterna fusca, *Frolich.* Carlton House and north end of Lake Winnipeg.
Dichelonycha subvittata, *Lec.* North end of Lake Winnipeg.
Trichius piger, *Fabr.* North end of Lake Winnipeg, and lat. 54° N.
Chrysobothris scabripennis, *Lap.* North end of Lake Winnipeg.
Melanophila longipes, *Say.* Mackenzie River, Great Slave Lake, and north end of Lake Winnipeg.
Dicerca tenebrosa, *Kirby.* Locality not recorded.
" prolongata, *Lec.* Carlton House, and north end of Lake Winnipeg.
Ancylocheira Nuttalii, *Kirby.* North end of Kake Winnipeg, and lat. 54° N.

Limonius vagus, *Sec.* Locality not recorded.
Corymbites Kendali, *Kirby.* Lat. 54° N., long. of Lake Winnipeg.
" æripennis, *Kirby.* North end of Lake Winnipeg.
Campylus denticomis, *Kirby.* " " "
Collops vittatus, *Say.* " " "
Clerus (*Thanasimus*) undulatus, *Say.* Mackenzie River and Great Slave Lake.
Corynetes violaceus, *Fabr.* Carlton House and north end of Lake Winnipeg.
Anobium foveatum, *Kirby.* Locality not recorded.
Mordella pustulata, *Mels.* North end of Lake Winnipeg.
Meloe rugipennis, *Lec.* " " "
Serropalpus substriatus, *Hald.* " " " and lat. 54 N.
Upis reticulatus, *Say.* Abundant, Carlton House and north end of Lake Winnipeg.
Pitho niger, *Kirby.* North end of Lake Winnipeg.
Pissodes affinis, *Randall.* " " "
Lepyrus colon, *Linn.* (*fide Kirby.*) " "
Alophus (*not determined*). Locality not recorded.
Cleonus (*not determined*). " " "
Bostrichus pini, *Say.* North end of Lake Winnipeg.
Criocephalus agrestis, *Kirby.* " " " and lat. 54° N.
Phymatodes proteus, *Kirby.* North end of Lake Winnipeg; lat. 54° N. and long. of Lake Winnipeg; Great Slave Lake; and Mackenzie River.
Clytus undulatus, *Say.* Mackenzie River, Great Slave Lake, and north end of Lake Winnipeg.
" longipes, *Kirby.* North end of Lake Winnipeg.
Monohammus scutellatus, *Say.* Mackenzie River, Great Slave Lake and lat. 54° N.
Rhagium lineatum, *Oliv.* Mackenzie River and Great Slave Lake.
Acmæops proteus, *Kirby.* North end of Lake Winnipeg, lat. 54 N. and Great Slave Lake.
*Leptura Chrysocoma, *Kirby.* " " " "
Chrysomela multipunctata, *Say.* Abundant, Carlton House.
" scripta, *Fabr.* Mackenzie River and Great Slave Lake.
" interrupta, *Fabr.* North end of Lake Winnipeg.
" Adonidis, *Fabr.* Mackenzie River and Great Slave Lake.
" Polygoni, *Linn.* North end of Lake Winnipeg.
" cyanea, *Mels.* " " "
Bromius vitis, *Fabr.* Mackenzie River and Great Slave Lake.
Hippodamia quinquesignata, *Kirby.* Lat. 54° N., long. of Lake Winnipeg.
Coccinella 12-maculata, *Gebler.* North end of Lake Winnipeg.
" transversoguttata, *Falderm.* " " "
" lacustris, *Lec.* " " "
Mysia 15-punctata, *Oliv.* " " "

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* This species occurs at Quebec in July.

ANNUAL REPORT OF THE COUNCIL OF THE NATURAL HISTORY.

Presented to the Society, May, 1860.

In presenting the customary annual Report, the Council have to congratulate the Society on the marked increase in its usefulness and prosperity in the past year, consequent, in part, on the present commodious and well-placed Building, and in part on the increased numbers and activity of its members.

In the past year the internal arrangements, and furniture of the building, have been completed; large additions have been made to the Museum; many important original investigations have been undertaken by members of the Society, and the results have been published in its proceedings. The annual Somerville course of free lectures has been successfully delivered. These lectures, as well as the ordinary meetings, have been even more largely attended than in former years.

The publication of the *Naturalist* has been carried on with its usual success; and the number of members has steadily increased, while the meetings have been occupied much more fully than formerly, by discussions of a scientific character. These successes have not been attained without much labor and expense; but we have the satisfaction of announcing that the Government and Legislature have, at length, adequately acknowledged the claims and Provincial utility of the Society, by a grant in aid of its funds.

Of the points above briefly noticed, some require a more detailed mention, which may be given under the following heads:—

ORIGINAL PAPERS READ.

Of the different departments in which this Society endeavors to promote the cause of Canadian science this must be regarded as the chief. We do not desire to undervalue the important work of collecting specimens for our Museum; but it is to be regarded as, in some respects, merely amassing the material on which skilled labor must be expended. The popular exposition of scientific principles in our public lectures is also a valuable means of cultivating the love and pursuit of science. The original

investigations, carried on by members of the Society and published by it, must, however, give it its standing among other scientific bodies, and it is by these that the value of its operations will be estimated abroad.

In this important department much has been done in the past year, and the Society has now connected with itself a zealous and constantly increasing band of laborers, who are daily extending the limits of our knowledge of Canadian Natural history and allied subjects.

In the department of Ethnology and social statistics, several valuable communications have been presented to the Society. One, by Principal Dawson, had reference to the art of Pottery, as practised by the aborigines of Canada, and evidenced by an ancient Indian vase in the collection of the Society. Another from an anynomous correspondent, is a very interesting notice of the manners and present condition of the Indian tribes of the McKenzie River, and the Arctic coast of America. Another, prepared by a committee of the Society, relates to certain points of interest connected with the Egyptian antiquities, presented by Mr. Ferrier, and especially to the antiquity and mode of preparation of the mummied remains contained in the collection. A fourth, the most important of the whole, is an elaborate investigation of the vital statistics of Canada, by Mr. P. P. Carpenter, a paper which, it is hoped, will not be merely a contribution to knowledge, but will give a practical stimulus to the sanitary improvement, so much needed for the comfort and health of the laboring classes in our towns.

In Botany the Society has received a number of catalogues, which must be regarded as important contributions to our knowledge of the geographical distribution of American plants. The principal are, that of the Holmes Herbarium of the University of McGill College, prepared by the late Prof. Barnston, that of Prescott plants, by Mr. B. Billings, that of the plants of the river Rouge, by Mr. D'Urban, and of the Algæ of the St. Lawrence, by the Rev. Mr. Kemp. In addition to these, we have had very interesting papers on the Reproductive system of *Vaucheria*, and on the mode of studying the Algæ, by Mr. Kemp ; on the genus *Allium*, as found in Canada, by Mr. G. Barnston ; and we may properly add here an interesting biographical sketch of the Great Western explorer, Douglas, by the same author.

In Zoology Mr. Bell has given us the most complete list hitherto published of the marine and fresh-water mollusks and radiates of the St. Lawrence, beside a number of other facts, bearing on the Zoology of that region. Mr. D'Urban has done a similar service for the previously unexplored valley of the River Rouge. Both gentlemen, it is proper to state, are protegés of the head of the Canadian Geological Survey, and have done these services to science under his auspices. Dr. Gibb, of London, an old and valued friend of the Society, has contributed some curious notes on the sounds produced by American insects; and Dr. Dawson has presented to us a complete summary of the natural history of the tubicolous marine worms of the Gulf of St. Lawrence, and the description of a new Canadian fish, the *Gasterosteus gymnetes.*

Geology is a department always likely to take an important place in the labours of this Society, more especially as the officers of the Geological Survey of Canada are among our most valued and active contributors. In this subject we have to notice three papers by Prof. Dawson, one on the microscopic structures of our Canadian limestones, and on the origin of these great sheets of calcareous matter in the deposition of the comminuted fragments of shells and corals, another in continuation of the Geology of the tertiary deposits of the lower St. Lawrence, and a third which for the first time brings the Silurian rocks of the peninsula of Nova Scotia into comparison with those of other parts of America. To this last paper, Prof. Hall, of Albany, has added descriptions of the new species of fossils, characteristic of these rocks. Mr. Billings is, as usual, one of our most important contributors. His papers on American Trilobites, on new genera of *Brachiopoda*, on the fossils of the Chazy Limestone, and on new species of fossils from the middle and lower Silurian rocks of Canada, are all steps in advance in Canadian palæontology, of which any Society might be proud to be the medium. We have also to thank Mr. Hunt for contributions to chemical Geology, which if not first published by this society, have at least through its means been more widely made known in Canada. Lastly, the series of original papers for this session has been fitly closed by the very interesting paper read by Sir W. E. Logan, at the April meeting of the Society, on the extraordinary impressions recently found in the Potsdam sandstone at Perth, C.W., constituting with the singular *Protichnites*, previously discovered by the same geologist, some of the oldest and most wonderful traces of life preserved in our Canadian rocks.

In addition to the original contributions above referred to, many abstracts and reviews of papers and other publications important to Canadian science, have been prepared by members of the Society and published in the *Naturalist.*

It was deemed proper by the Council to prssent to His Royal Highness the Prince Consort, on the occasion of his presiding at the meeting of the British Association in Aberdeen, a copy of the *Naturalist* from the commencement. This duty was performed by the President; and the volumes bound in the best style by Mr. Lovell, were presented and graciously received. The correspondence on this subject is appended to the Report.

PUBLICATION OF THE NATURALIST.

The editing committee report that since last annual meeting Vol. IV. has been completed. It consists of 504 pages, 8vo., being 24 pages larger than Vol. III., and contains twenty-two original articles presented to, or read before the Society, and written expressly for the Magazine, occupying ......Pages 217

Fourteen selected articles—many of which, though written for other purposes, were first published in its pages; and others of which were revised and amended by the authors—occupying............................ 191

Miscellaneous Matter, nearly all original, as Reviews of Books, Correspondence, and the Societies' Reports.......... 96

504

Wood engravings have been as usual, freely furnished by the publishers, who still continue with great liberality to publish the Magazine at some loss to themselves. The Editing Committee regret that the proceedings of the Society have not been so regularly reported in the *Naturalist* as is desirable, and recommend that, in future, this duty be assigned to the Committee.

The circulation of the *Naturalist* has not materially increased: nor do the Committee anticipate any great improvement in this respect, until the Society shall be in such a position as to procure a copy for each of its members, and to distribute the work more extensively in Great Britain, and in foreign countries. The *Naturalist* is doing a most important work in Canada, in stimulating the taste for natural science, and in giving the means of publication to observers; but its value as a medium of publication and

as a means of extending the knowledge of Canada and of enlarging its scientific reputation, is much diminished by the restricted circulation abroad, necessitated by the narrow pecuniary circumstances of the Society. A vigorous effort should be made to remove this evil in the coming year, and to secure for the *Naturalist*, now by far the most important representative of the state of Natural Science in Canada, the circulation which its merits demand.

In thanking the Editing Committee for its services, the Council regard it as nothing more than an act of justice to make especial mention of the services of Mr. D. Allan Poe, on whom the immediate editorial superintendence of the *Naturalist* has devolved, and to whose skill and unwearied attention much of the success of the publication is due.

MUSEUM AND LIBRARY.

The arrangement and improvement of the Society's collection, have been steadily advancing, and the cabinet-keeper, Mr. Hunter, deserves great credit for the zeal which he has displayed in this, as well as in adding to the collection by preparing and setting up numerous specimens of animals presented to the Society. The report of the Curator, Dr. Fenwick, shows that the number of donations has been very large. The most important of the whole is the Ferrier collection of Egyptian antiquities, which is one of the most attractive features of the collection. As at present arranged, the Society's collection of Canadian birds is remarkably complete and available for reference. The collection of Mammals, though containing a number of good specimens, is still very defective. It is much to be desired that members interested in these subjects, would bring up to the same degree of perfection with the birds, the collection of Canadian Invertebrate Animals, Plants, Fossils and Minerals. In all of these departments there is a great amount of material of little comparative value in consequence of the want of modern scientific arrangement. The aquaria, which we owe to the exertions of Mr. Leeming and Mr. Ferrier, now constitute a portion of our Museum of much interest and some scientific value.

The donations to the Library have been comparatively few, and the state of the Society's funds has not permitted the purchase of books. It is hoped, however, that something may ere long be done in this direction, as the library is now much in want of

many of the more modern works on Natural History. There is also a prospect that the Committee appointed to organize a system of exchanges for the *Naturalist*, may be able in this way to procure for us some of the scientific periodicals, not now received by the Society.

It would be of much service to the students of Natural science in Montreal, were there a mutual understanding between the institutions having libraries of reference on science, as, for instance, the McGill College, the Board of Arts and Manufactures, the Geological survey, and this Society, that in ordering books the one should endeavor, as far as possible, to supplement the deficiencies of the others. The subject is worthy of the attention of the Library Committee in the coming year.

PUBLIC LECTURES.

The Somerville course for the past year consisted of the following Lectures:—

1.—On the uses and advantages of Foreign Travel, by the President, the Lord Bishop of Montreal.

2.—On Crystallization as a force in Nature, by Principal Dawson.

3.—On the History of Astronomy, by Prof. Johnson.

4.—On the Microscope, by T. D. King, Esq.

5.—On the Oyster, by J. Leeming, Esq.

6.—On Mountains and Volcanoes, by Prof. Hunt.

In addition to the ordinary Course, the exhibition of the Ferrier collection furnished the occasion of two interesting lectures on the present and ancient state of Egypt, for which we have to thank the Rev. Prof. Cornish and Mr. R. W. Ferrier.

FINANCIAL POSITION.

The Treasurer's accounts for the past year still exhibit the effects of the increased expenditure attendant on the removal of the Society to its new building, on which there also remains a debt, secured by mortgage and note, of £850. The Society is now, however, owing to its improved accommodation, in a position much more efficiently to carry out its objects, to increase its membership, and to merit that support from the public and the Legislature, which there is now good reason to expect.

In the coming year the Legislative aid and members' fees will suffice to meet all the unpaid accounts and interest of the debt,

and to provide for the current expenses; and it is hoped that in subsequent years, by economical management, some reduction of the debt may be effected, and means reserved for additions to the Library, and for more extensively promoting the circulation of the proceedings of the Society abroad.

GENERAL RECOMMENDATIONS.

Toward the close of the last Session two important branches of the operations of the Society were initiated, in the organization of a Microscopical Section, and in the appointment of a Committee on adulterations of articles of food. They have not as yet reported to the Council, but they are warmly commended to the fostering care of our successors.

It is the practice in most Societies similar to this, that an address on the progress of science in connection with the Society should be prepared and delivered by the President at the Annual Meeting. This has usually been done by us in an imperfect manner in the report of the Council; but the operations of the Society are now so important that this can scarcely any longer suffice, and your Council, therefore, recommend that in future it shall be considered as a part of the duty of the retiring President, and, in his absence, of the 1st Vice-President, to prepare an address for the Annual Meeting, including notices of the papers read and of the other operations of the Society. The report of the Council will then be confined to the business affairs of the Society.

The approaching visit of His R. H. the Prince of Wales will demand on the part of our successors an effort to represent as effectually as possible those departments of Canadian science which specially belong to the Province of this Society. This especially merits attention, inasmuch as the Board of Arts and Manufactures has selected for its exhibition building the ground adjoining that occupied by the Society. Our collections will thus be brought under the notice of a much larger number of visitors than usual, and it is possible that some arrangement might be made for rendering our museum still more useful by opening it as a part of the Great Exhibition to be held on that occasion.

Presentation of the "Naturalist" to H. R. H. Prince Albert.

See House, *Montreal*, May 6, 1859.

Sir,—At a recent meeting of the Incorporated Montreal Natural History Society, I was requested to forward to you the accompanying volumes of a bi-monthly periodical issued by that Society, entitled the "Canadian Naturalist," which they desire, through you, to be allowed respectfully to offer to H.R.H. the Prince Consort. The different articles in the magazine are written by the members of the Montreal Natural History Society, and the plates are executed and the work printed and bound in this city. It may, therefore, be considered as a specimen of the progress that is making here in Natural Science and in the Arts. And from the interest which His Royal Highness takes in receiving things connected with these matters, and as he is himself to be President at the ensuing meeting of the British Association for the advancement of Science, we are led to believe that these volumes will meet with a favourable reception.

I have the honor to be, Sir,

Very respectfully,

Your faithful Servant,

(Signed) F. Montreal

Vice President of the Montreal Natural History Society.

To the Right Hon.
Sir E. Bulwer Lytton, Bart., M.P.,
Secretary of State for the Colonies.

Governor's Secretary's Office,
Toronto, July 23, 1859.

My Lord,—I am directed by His Excellency the Governor General to transmit herewith a copy of a despatch from the Secretary of State for the Colonies, acknowledging the receipt of your Lordship's letter of the 6th of May.

I have the honor to be, my Lord,

Your Lordship's obedient Servant,

(Signed) R. T. Pennefather.

The Right Rev.
The Lord Bishop of Montreal.

[Copy, Canada, No. 4.]

DOWNING STREET,
27th June, 1859.

SIR,—My predecessor in this Department received from the Bishop of Montreal, as Vice-President of the Natural History Society of Montreal, a letter dated the 6th of May last, accompanied by volumes of a periodical issued by the Society, entitled the "Canadian Naturalist," which they desired to offer to his Royal Highness the Prince Consort.

His Royal Highness has requested that the expression of His Royal Highness's best thanks may be conveyed to the Bishop of Montreal, and to the Society over which he presides, for the valuable work which they have sent to him, and the assurance of the high value which he shall attach to these volumes as the sign of the cultivation of the Sciences and Arts in the important North American Colonies of Her Majesty.

I have, &c.,
(Signed) NEWCASTLE.

STATEMENT OF LIABILITIES OF THE NATURAL HISTORY SOCIETY.

1st *May*, 1890.

Sundry open accounts,	$ 673 97
Interest due on Mortgages,	257 50
Balance due Treasurer,	126 28
The Society's note due July 11, 1860,	1000 00
Mortgage favor of Wm. Watson, Esq.,	400 00
Do. Do. Wm. Nivin, Esq.,	2000 00
	$4457 75

JAMES FERRIER, JR.
Treasurer.

MONTREAL, 1st May, 1860.

(*To be continued in next number.*)

NATURAL HISTOTY SOCIETY OF MONTREAL IN ACCOUNT WITH JAMES FERRIER, Jr.

RECAPITULATION.

Date	Particulars	Dr.
1859.		
May 1.—To	Balance due the Treasurer,	$719 43
1860.		
May 1.—To	Cash paid Salaries,	200 00
"	" " C. McCormick, Commissions, &c	31 00
"	" " Gas and Water Rent,	49 61
"	" " Fuel,	129 96
"	" " Advertising and Printing,	67 30
"	" " Interest,	221 32
"	" " Insurance,	38 00
"	" " Notarial Expenses,	38 00
"	" " Museum Fixtures,	58 50
"	" " Aquaria,	147 08
"	" " On Account Building,	495 52
"	" " Incidental Expenses,	35 48
		$2,231 20

Montreal, May 1, 1860, Examined and found Correct.
Signed, ALEX. GORDON,
" J. H. JOSEPH,
" JAMES MILNE.

RECAPITULATION.

Date	Particulars	Cr.
1860.		
May 1.—By	Cash Received from Annual Subscription Diplomas,	$ 504 00
"	" Received from Life Members and Special,	110 00
"	" Received from Admission fees to Museum,	46 75
"	" Proceeds of Lecture on Egypt,	64 50
"	" From American Association Committee, balance,	271 67
"	" From L'Institute Canadien, interest to 1st July on £600,	108 00
"	" Wm. Nivin, Esq., on loan,	1,000 00
"	Balance due the Treasurer,	126 28
		$2,231 20

E. & C. E.

Signed,
JAMES FERRIER, Jr.
Treasnrer N. H. S.

MONTREAL, 1st May, 1860.

NATURAL HISTORY OF THE VALLEY OF THE RIVER ROUGE.

ERRATA.

1st *Part. Vertebrata, Vol. IV.*

Page 254, line 10 from bottom, for " he " and " his," read *it* and *its.*
" 268, " 8 " top, " " 40th " read 30*th.*
" 269, " 18 " bottom, " "879 " " 379.
" 271, " 14 " top, " " congregatiug " read *congregating.*
" 271, " 17 " top, " " 2 " read 3.
" 273, " 3 " bottom, " " causes " read *cause.*

2nd *Part. Invertebrata. Vol. V.*

" 82, " 16 from top, for " vitresis " read *vitreus.*
" 82, " 20 " top, for " rutator " read *scrutator.*
" 83, " 9 " bottom, for " Nichius " read *Trichius.*
" 83, " 16 " " " " microphagus " read *miarophagus.*
" 84, " 31 " top, after Nyctobates, for " not determined" read *not described.*
" 84, (note), line 6 from bottom, for " Ellydina " read *Ellychnia.*
" 85, line 9 from bottom, for " lateripolia " read *laterifolia.*
" 85, " 11 " " " " pontatis " read *frontatis.*
" 86, " 5 " top, for " cappripennis " read *cupripennis.*
" 86, " 11 " " " " Tenebris " read *Tenebrio.*
" 88, " 18 " bottom, for " Ardepias " read *Asclepias.*
" 91, " 26 and 29 from top, for " Shipper " read *Skipper.*
" 93, " 14 from top, for " Medaria " read *Mudaria.*
" 93, " 7 " bottom, for " Sophocanipa " read *Lophocampa.*
" 93, " 7 " " " " Jussock " read *Tussock.*
" 94, " 12 " " insert *Guén* after " Plusia mortuorum."
" 95, " 1 " top, insert *Walker* after "Ellopium aquallaria."
" 95, " Bleptina surrectalis " should precede " Pyralis n. sp.
" 95, line 1 from bottom, for " Samhercalis " read *Samhucalis.*
" 96, " 9 " top, for "Miero-Lepidoptera" read *Micro-Lepidoptera.*
" 97, " 4 " " " " Doran " read *Dolan.*
" 97, " 6 " bottom, for " galhauns " read *galhanus.*
" 98, " 8 " top, for " companulatus " read *campanulatus.*

MONTHLY METEOROLOGICAL REGISTER, ST. MARTINS, ISLE JESUS, CANADA EAST, (NINE MILES WEST OF MONTREAL,) FOR THE MONTH OF APRIL, 1860.

Latitude, 45 degrees 32 minutes North. Longitude, 73 degrees 36 minutes West. Height above the level of the Sea, 118 feet.

BY CHARLES SMALLWOOD, M.D., LL.D.

Day of Month.	Barometer—corrected and reduced to 32° F. (English inches.)			Temperature of the Air.—F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.			Direction of Wind.			Horizontal Movement in 24 hours. In miles.	OZONE. Mean amount of, in inches.	RAIN. Amount of, in inches.	SNOW. Amount of, in inches.
	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.				
1	29.371	29.367	29.521	34.0	40.0	27.1	.175	.182	.117	.89	.73	82	E. S. E.	N. W.	N. N. E.	152.20	8.0	......	......
2	788	650	700	10.0	20.0	17.0	.054	.065	.068	.78	.62	.75	N. by W.	W.	S. W.	251 30	0.0	......	......
3	574	347	351	20.1	32.1	31 9	.081	143	.156	.77	.79	.89	S. by E.	S. S. E.	N. E. by E.	59.70	10.0	......	0 75
4	420	367	294	29.0	42.0	36.0	.142	199	.170	.88	.74	.80	N. E. by E.	N. E. by E.	N. E. by E.	60.70	1.5	......	......
5	227	250	451	34.1	38 2	31.2	.180	.201	.149	.90	85	86	N. E. by E.	N. E.	N. E.	178 80	7 6	0.500	......
6	670	662	801	30 1	46.7	34 1	.118	.232	.175	.89	73	.80	N. W.	N. N. E.	S. S. W.	74.00	3.5	......	1.60
7	958	684	722	39.1	56.8	40.1	.136	.320	208	82	.72	.80	S. S. W.	S. S. W.	S. E.	5.00	0.0	......	......
8	551	441	616	38.4	40.2	41.0	.214	225	235	.98	.91	.91	S. S. E.	S. S. E.	S. by W.	16.80	10.0	0.583	......
9	654	747	972	38.0	58.0	38.0	203	.365	.151	.83	.76	.70	N. N. E.	W. S. W.	N. N. E.	17 00	2.0	......	......
10	900	654	261	28.6	42.0	40.1	.129	.184	225	.82	.70	90	N. E. by E.	S. S. E.	S. S. E.	56.40	8.0	0 160	......
11	570	484	647	33 4	49.6	37.7	.182	290	.193	95	.82	.87	W. by N.	N. N. W	N. by W.	233.40	5.0	......	......
12	801	402	347	30 1	55.3	42.2	.148	.321	.237	.89	.74	.89	E.	S by E.	S. E.	15 00	3.0	0.290	Inapp.
13	312	479	515	34.2	41.0	40.2	.170	169	.203	86	.65	.82	W. S. W.	W.	S. W.	225.30	3 5	......	......
14	492	647	742	24.2	26.4	18.9	.083	.082	.061	66	.57	60	W. N. W.	W. N. W.	W. N. W.	379 50	2.5	......	......
15	30.090	911	980	12.1	32 0	27.8	045	.112	.117	69	63	78	W. N. W.	W. S. W.	S. W.	402 40	1.5	......	......
16	092	971	860	32.0	36 4	34 6	.113	136	.169	79	.65	.84	S. S. E.	S. S. E.	S. S. E.	31 40	1.0	0.500	......
17	29.301	204	990	40.1	56.1	36.1	.225	336	.170	.91	.75	80	S. S. E.	W. S. W.	W. N. W.	423.40	2.5	......	......
18	30.381	30.224	30.260	25.0	43 2	29.2	.110	186	.136	75	67	.84	N. N. W.	S. W. by S.	S. S. W.	213.30	1 0	......	......
19	272	29.914	29 869	30.0	60.1	43.4	.130	.395	.224	.78	.75	.79	W. by S.	S. W.	S.	13.10	1 0	......	......
20	29.842	311	417	36.7	64 9	50.2	.164	.451	.303	76	.73	88	S. S. E.	S. S. E.	S. S. W.	129.80	1 0	......	......
21	437	347	414	43.0	63.7	48.0	.254	.416	.285	.91	72	85	E.	E. by E.	N. E. by E.	41 10	1.5	......	......
22	594	314	114	36.7	61.7	50.5	177	.406	.283	.85	.74	78	N. E. by E.	E. S. E.	S.	195.10	1.5	......	......
23	590	414	574	34.2	54 0	39 0	155	282	.167	79	.67	.68	W. N. W.	W. S. W.	W. N. W.	167.80	1.0	......	......
24	630	454	690	31.0	39.8	30.0	136	.131	.130	.77	.55	70	W. N. W.	W. S. W.	W. N. W.	151 10	1 5	......	......
25	671	740	714	25.4	43.0	38.3	.100	.280	.182	74	.88	.79	S. S. W.	S. E.	S. S. W.	100 90	2.5	......	0.10
26	557	561	811	37.2	53.0	42.7	.178	.269	.215	81	.67	78	W. S W.	W.	W. N. W.	152 09	1.0	......	......
27	914	901	954	35.2	55 2	40 3	.162	218	203	80	.50	.82	S. W. by W.	W. by N.	W. S. W.	143 30	1.0	......	......
28	30 001	912	847	32.7	67.4	46.3	.137	274	192	.74	.41	.62	S. S. W.	S. by E.	S. E.	19 27	1.0	......	......
29	952	900	947	35.4	72.1	55 2	127	.270	269	62	.32	.62	N. E. by E.	S. E. by E.	S. E. by E.	130.23	1.0	......	......
30	976	912	874	43.0	76 2	57.0	.209	305	230	.75	34	.51	E. S. E.	S. E.	E. S. E.	151. 10	0.5	......	......

WEATHER, CLOUDS, REMARKS, &c. &c. [A cloudy sky is represented by 10, a cloudless one by 0.]

Day	6 a. m.	2 p. m.	10 p. m.
1	Cu. Str. 10.	Cu. Str. 10.	Cirr. 4. Lunar Halo.
2	Clear.	Clear.	Clear.
3	C. C. Str. 10	Cu. Str. 10.	Snow.
4	Cu. Str. 4	Clear.	Clear.
5	Rain.	Cu. Str. 4.	C. C. Str. 8.
6	Snow.	Clear.	Clear.
7	Clear.	"	"
8	Rain.	Rain.	Cu. Str. 10.
9	Cu. Str. 4.	Cu. Str. 2.	Clear. Aurora Borealis.
10	" 4.	St. 10.	Cu. Str. 10.
11	Clear.	Cu. Str. 4.	Rain.
12	"	Cir. Str. 4.	Cu. Str. 10.
13	Cu. Str. 10	C. C. Str. 4.	" 4. Aurora Borealis.
14	" 6.	Clear.	Clear. " "
15	"	"	"
16	"	"	"
17	Rain with Thunder.	Cu. Str. 4.	"
18	Clear.	Clear.	" Aurora Borealis.
19	"	"	"
20	Cu. Str. 4.	C. C. Str. 8.	Cu. St. 10
21	C. C. Str. 8.	Clear.	" 10.
22	" 4.	"	Clear.
23	Clear.	"	C. C. Str. 4
24	Cu. Str. 10.	Cu. Str. 4.	Snow.
25	" 2.	C. C. Str. 2.	Cu Str. 4.
26	Clear.	Clear.	Clear.
27	"	"	"
28	"	"	"
29	"	"	"
30	"	"	"

REPORT FOR THE MONTH OF MAY, 1860.

Day of Month.	Barometer—corrected and reduced to 32° F. (English inches.)			Temperature of the Air.—F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.			Direction of Wind.			Horizontal Movement in 24 hours. In miles.	OZONE. Mean amount of	RAIN. Amount of, in inches.	SNOW. Amount of, in inches.
	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a.m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.				
1	29.970	29.900	29 930	19.0	79.5	23.8	.228	.217	.269	64	26	.67	S. E.	S. E.	S. E.	125.30	0 0	......	......
2	30 140	890	920	44.9	69 9	53.2	.275	.360	.288	.92	.50	70	S. E.	E, by S.	N. E.	14 60	0.5	......	......
3	29.090	842	725	47.3	74 5	59.0	.291	270	.318	.89	.32	63	E.	S. W. by W.	S. S. E.	8.50	0.5	......	......
4	820	711	624	50 0	74.1	59.1	.256	.263	.352	.71	.31	.70	E. S. E.	N. E. by E.	N. E. by E.	131.10	1 5	......	......
5	860	954	981	57.0	73.2	58.4	.262	.345	357	55	42	.70	N. N. E.	S. S. E.	S. by E.	0.10	1.0	......	......
6	30.017	997	30.001	47.0	84 2	62.2	.207	.515	347	.81	.47	.64	S. E.	S.	S.	12 20	1.0	......	......
7	29.920	902	046	54.5	72.1	57.9	.383	.489	.385	90	62	.84	S. by E.	S. E.	N. N. E.	87.70	1 5	......	......
8	990	941	001	47.0	74.2	60.9	267	532	.449	80	.63	85	N. N. E.	S. S. W.	S. S. W.	153.40	1 5	......	......
9	30 146	30.050	061	56.1	58.5	56.3	.391	.452	413	87	94	.90	S. E.	S. E.	S. E.	100 10	3.0	Inapp.	......
10	29.917	29.814	29.879	52.2	63.4	57.4	368	543	.452	96	.94	.94	S. E.	E. S. E.	S. S. E.	249 10	5.0	0.160	......
11	611	846	30.056	60.3	76.1	63.6	.480	.541	.510	.91	.60	88	S. S. E.	S. S E.	S. S. E.	11.16	5.3	......	......
12	998	30.004	110	64 2	81.6	69.2	.529	.617	.635	89	.58	.90	S. S. E.	S. by W.	S. S. E.	2.70	0.0	......	......
13	980	29.894	29.914	59.6	83.1	65.6	.403	.597	.337	79	.53	59	S. S. E.	E. by S.	S. E. by E.	84.50	1.3	......	......
14	871	747	797	63 8	70.1	51.0	.341	.390	270	.83	.30	.72	E. by N.	N. E. by E.	N. E. by E.	311.70	0 0	......	......
15	800	831	814	41.1	72 2	56 7	218	.327	.359	76	.42	.78	N. by E.	S. S. E.	W. S. W.	199.70	0.0	......	......
16	771	30.040	30.090	46 0	60.2	47.1	.262	.216	.256	84	43	81	N. E. by E.	E. N. E.	E. by S.	222 80	0.0	......	......
17	30.110	004	119	45 5	72 4	53.0	.198	.524	.321	65	66	.89	N. by E.	S. S. E.	S. S. E.	44.64	0.0	......	......
18	29.917	29 900	29 790	50.1	64 6	60.3	.326	.285	.426	.93	.48	.82	S. S. E.	S. by E.	S. by E.	113.62	6.6	Inapp.	......
19	489	279	187	61.1	63.0	55 0	480	.491	.375	.90	.88	.93	S. S. E.	S. S. E.	S. W.	100.10	5.5	2.670	......
20	360	639	817	32.1	38 7	34 1	.162	123	.155	.89	54	.79	W.	W. N. W.	N. by W.	255.20	4.0	0.712	0.70
21	997	914	874	35 1	55.5	46.3	.127	218	238	.62	.50	.78	W.	S. S. E.	S.	24.80	1.5	......	......
22	738	819	910	47.0	51.9	48 1	.298	.315	.310	.92	.83	.92	S. S. W.	N. W.	N. W.	26.80	3 0	......	......
23	997	982	30.004	44 2	71.3	56.9	.214	.347	415	.83	.46	.90	N. W.	W. by S.	S. E.	24 20	2 5	......	......
24	30.052	30.011	002	49.5	71.6	59.0	.297	.503	410	85	66	.82	E. S. E.	S. W.	S. E. by E.	39.10	1 0	......	......
25	29.904	29.879	29.891	52 6	85 7	67.4	.354	610	.420	90	50	.63	S. by W.	S.	E. S. E.	8 80	2 0	......	......
26	802	800	697	57.2	78.0	63.6	.372	.323	.416	.78	.35	72	E. by S.	E. by N.	S. W.	228.50	1.5	......	......
27	647	582	711	53.3	63.7	56 1	.348	.471	.390	86	81	86	S. E. by E.	S. S. E.	S. S. E.	217.20	2 0	0.732	......
28	719	774	871	54.0	63.9	55.7	.355	.409	.370	.84	70	.84	S.	N. E. by E.	S. E.	39.49	2.5	......	......
29	927	991	917	51.2	78.2	65.7	.245	.594	.509	65	.63	.81	S. S. W.	W.	W. by S.	113.80	2.5	......	......
30	957	719	697	61.0	73.2	61.7	.419	.545	.383	.80	.67	.71	S. S. W.	S. W.	S. S. W.	20.50	1 5	Inapp.	......
31	642	571	609	63 0	76.3	62.1	.478	.577	.460	.83	.64	.83	S. W.	W. by N.	S. W. by W.	206.70	2.5	0.007	......

WEATHER, CLOUDS, REMARKS, &c. &c. [A cloudy sky is represented by 10, a cloudless one by 0.

Day	6 a. m.	2. p. m.	10 p. m.
1	Clear.	Clear.	Clear.
2	Hazy.	"	"
3	Clear.	"	"
4	Cu. Str. 10.	"	"
5	Clear.	"	"
6	"	"	"
7	Hazy.	"	Cu. Str. 10.
8	Cu. Str. 4.	Cu. Str. 4.	Clear.
9	Clear.	" 10.	Cu. Str. 10. Parhelia.
10	Cu. Str. 4.	" 4.	Slight Rain.
11	" 4.	" 4.	C. C. Str. 8.
12	Clear.	Clear.	Clear. Aurora Borealis.
13	"	"	Cu. Str. 4. Solar Halo, dist. H.
14	"	"	Clear. Solar Halo.
15	"	"	"
16	"	"	"
17	"	"	"
18	"	Cu. Str. 10.	Cu. Str. 4. Light in S. W.
19	Cu. Str. 10.	Rain.	Rain.
20	Snow.	Cu. Str. 6.	Clear.
21	Clear Frost.	C. C. Str. 8	Cu. Str. 8.
22	Cu. Str. 10.	Cu. Str. 10.	" 8.
23	Clear, Slight Frost.	Clear.	" 8.
24	Cu. Str. 8.	"	" 4.
25	Clear.	Clear.	Cirr. Str. 4.
26	"	Cu. Str. 9.	" 9. Distant Lightning.
27	Rain, thunder.	" 8.	" 8.
28	Clear.	" 2.	Cirr. Str. 4.
29	Cu. Str. 10.	Cir. Str. 8.	C. C. Str. 4.
30	C. C. Str. 8.	" 4.	" 4.
31	" 8.	C. C. Str. 4.	" 8.

REMARKS FOR APRIL, 1860.

Barometer { Highest, the 18th day, 30·381 inches. Lowest, the 5th day, 29.227 " Monthly Mean, 29.669 " " Range, 1.154 "

Thermometer... { Highest, the 30th day, 76°7. Lowest, the 2nd day, 10°0. Monthly Mean, 40°29. Monthly Range, 66°7.

Greatest intensity of the Sun's rays, 90°9.
Lowest point of Terrestrial radiation, 7°6
Mean of Humidity, .753.
Rain fell on 5 days, amounting to 1.733 inches; it was raining 26 hours and 10 minutes, and was accompanied by thunder on one day.

Snow fell on 4 days, amounting to 215 inches: it was snowing 14 hours and 40 minutes.
Most prevalent wind, the W. N. W.
Least prevalent wind, the E.
Most windy day, the 15th day; mean miles per hour, 17.64.
Least windy day, the 7th day; mean miles per hour, 0.20.
Aurora Borealis visible on 4 nights.
Lunar Halo visible on 1 night.
Parhelia visible on 1 day.
Swallows (*Hirundi Bicolor*) first seen on 24th day.
Frogs (*Rana Pipiens*) first heard on 20th day.
The Electrical state of the Atmosphere has indicated high and constant tenison of a negative character.

REMARKS FOR MAY, 1860.

Barometer. { Highest, the 9th day, 30.146 inches. Lowest, the 19th day, 29.187 " Monthly Mean, 29.864 " Monthly Range, 0.959 "

Thermometer. { Highest, the 12th day, 87°9. Lowest, the 21st day, 26°9. Monthly Mean, 59°85. Monthly Range, 61°0.

Greatest intensity of the Sun's rays, 99°2.
Lowest point of terrestrial radiation, 15°1.
Mean of humidity, .695.
Amount of Evaporation, 2·89 inches.

Rain fell on 7 days, amounting to 4.310 inches; it was raining 28 hours 52 minutes, and was accompanied by thunder on two days.
Snow fell on 1 day amounting to 0.007 inches, it was snowing 1 hour 15 minutes.
Most prevalent wind, the S. S. E.
Least prevalent wind, the E.
Most windy day, the 14th day; mean miles per hour, 12.99.
Least windy day, the 5th day; mean miles per hour inappreciable.
Aurora Borealis visible on 1 night.
Slight frost on the mornings of the 17th, 21st and 23rd days.

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ARTICLE XXXVII.—*A Systematic List of Lepidoptera collected in the vicinity of Montreal.* By W. S. M. D'Urban.

On my arrival in England, in the autumn of 1859, I placed the whole of the Canadian *Lepidoptera* I brought home with me, in the hands of Mr. Francis Walker, so well known for his attention to this order of Insects, and the author of the British Museum Catalogues of Lepidoptera Heterocera. He has lately returned my specimens to me carefully named, and has generously placed at my disposal his valuable descriptions of the new species for publication in the "Canadian Naturalist and Geologist."

Being persuaded that local lists are indispensable for a right understanding of the geographical distribution of the animals and plants of every country, I have drawn up a catalogue of those Lepidoptera which were taken in the neighbourhood of Montreal. The number of species (162) is, I am aware, but small, and the greater portion of them were taken during the first few months of my residence in Canada. I trust that others may be induced to turn their attention to this interesting order, and to form longer lists than the present, which, however, may be useful as the first step towards the much to be desired result of a complete catalogue of Canadian Lepidoptera. I think it is Agassiz, who says somewhere, that "a hitherto unrecorded locality for a

species accurately determined, is as great an addition to science as the discovery of a new species."

In June and July thousands of Noctuidæ may be taken by treacle spread on tree-trunks at night, and all the families of Heterocera swarm in lighted rooms when the windows are opened. If any one would take the trouble to catch and pin these or any other insects, and send them home to the British Museum, they would be thankfully received and acknowledged, and the new species would be described at length in the Catalogues, a large number of which have been already published. The late lamented Dr. Barnston presented numerous specimens from the Hudson's Bay Territories to that national institution, and it is greatly to be wished that others would follow his example. These specimens were collected by George Barnston, Esq., the father of Dr. Barnston.

A very large proportion of the Canadian genera are identical with the European, many of the species being also exactly similar, and to such I have affixed the mark (Eu).

The present Catalogue is carried as far only as the conclusion of the *Pyralideous Pyralidina.* I have handed over to Mr. Stainton the few Micro-Lepidoptera I collected, and he informs me that there are some interesting species amongst them, and that others are very similar to English forms. Several fine *Sphinges* captured near Montreal are in the collection of the Natural History Society, but their names are unknown to me.

Wishing to give an idea of the distribution of the species throughout America, I have added the localities where they have been recorded as occurring, as far as I have been able to ascertain from various sources, but principally from the British Museum Catalogues of Lepid. Het., to the end of the *Noctuina*, and in a few instances amongst the *Geometrina* and *Pyralidina.* Having had access to but few works, and but limited time in which to accomplish my undertaking, being just about to sail for the Cape of Good Hope, it is necessarily very incomplete, and I must claim indulgence for any errors of omission and commission of which I have been guilty.

Exeter, Devonshire, May 1860.

RHOPALOCERA, *Boisd.*

Family I. PAPILIONIDÆ, *Leach.*

Sub-Family I. PAPILIONIDI, *Steph.*

Genus 1, PAPILIO, *Linn.*

1. P. Asterias, *Fab.*, (Black Swallow-tail).—Abundant, June to September.

   Distribution.—West Indies, S. America, Georgia, Virginia, (Boisd.) ; Massachusetts, (Harris) ; New York, (Emmons) ; Ohio, (Kirtland) ; Newfoundland, (Gosse) ; does not occur in the Eastern Townships, at Sorel or Quebec (?)

2. P. Turnus, *Linn.*, (Tiger Swallow-tail).—Common, May to end of July.

   Distribution.—Virginia, Georgia, Carolina, (Boisd.) ; Newfoundland to Mexico, (Gosse) ; Massachusetts, (Harris) ; New York and Maine, (Emmons) ; Ohio, (Kirtland) ; Eastern Townships, Sorel, Rouge District, Quebec and Southern shores of the Gulf.

Sub-Family II. PIERIDI, *Steph.*

Genus 2, Colias, *Fab.*

1. C. edusa, *Fab.*, (Clouded Yellow).—One specimen, September 10th 1856.

   Distribution.—New York, (Boisd.) ; (Eu).

2. C. Philodice, *Godt.*, (Clouded Sulphur).—Very abundant, June to October.

   Distribution.—Throughout North America.

Genus 3, Pieris, *Schranh* ; Pontia, *Fab.*

1. P. oleracea, *Harris*, (Grey-veined White).—Not very numerous, May and June, August and September.

   Distribution.—Lake Superior, (Agassiz) ; Wisconsin and Ohio, (Kirtland) ; Massachusetts, (Harris) ; Eastern Townships, (Gosse) ; Upper Canada, Rouge District, Quebec and Southern shores of the Gulf. *P. Casta*, Kirby, a variety of this species occurs in the Hudson's Bay Territories.

2. P. Protodice, *Boisd.*, (see C. N. and G. vol. II, p. 347, pl. VI, figs. 3, 4, 5).—Lachine, (Dr. Barnston).

   Distribution.—New York, (Boisd.) ; Rochport, Ohio, (Kirtland) ; Connecticut.

Family II. HELICONIDÆ, *Swainson.*

Genus 1, Danais, *Boisd.* ; Euplœa, *Fab.*

1. D. Archippus, *Fab.*, Plexippus, *Cramer*, (Storm Fritillary) ; Common, June to August.

Distribution.—West Indies and Middle States, (Boisd.); South Carolina, (Abbot); Massachusetts, (Harris); Philadelphia, (Say); New York, (Emmons); Ohio, (Kirtland); Lake Superior, (Agassiz); Eastern Townships, (Gosse); Upper Canada, Rouge District, and Sorel.

Family III. NYMPHALIDÆ, *Swainson.*

Sub-Family I. SATYRIDI, *Steph.*

Genus 1, Debis, *Doubleday*?

1. D. Portlandia, *Boisd.*, Oreas-marmorea Andromacha, *Hubner*, (Pearly eyes).—Not common, July.

Distribution.—Western Prairies of Ohio, (Kirtland); Arkansas, but not in Pennsylvania, (Say); Massachusetts, (Harris); Eastern Townships, (Gosse) Rouge District.

Genus 2, Hipparchia, *Fab.*; Satyrus, *Boisd.*

1. H. Nephele? *Kirby.*—Common in grass-fields, July and August.

Sub-Family II. NYMPHALIDI, *Steph.*

Genus 3, Limenitis, *Fab.*

1. L. Arthemis, *Drury*, (Banded Purple).—Common, July and August.

Distribution.—Eastern Townships, (Gosse); Massachusetts, (Harris); Poland, Ohio, (Kirtland); Lake Superior, (Agassiz); North-West Territory, Lake Winipeg, Lake of the Woods, Upper Canada and Arkansas, (Say); Sorel, Rouge District, and South side of the Gulf.

Genus 4, Nymphalis, *Boisd.*

1. N. disippus, *Godt.*; Missippus, *Linn* and *Fab.*—Common, August.

Distribution.—New York, (Environs); Massachusetts, (Harris); Ohio, (Kirtland); L'Orignal, on the Ottawa, (Bell).

Sub-Family III. VANESSIDI, *Steph.*

Genus 5, Cynthia, *Fab.*

1. C. cardui, *Linn*, (Painted Lady).—Abundant in some years, September and October.

Distribution.—Massachusetts, (Harris); New York, (Emmons); Rochport, Ohio, (Kirtland); South shores of the Gulf and New Brunswick, (R. Bell); Sorel, (Eu.)

2. C. Huntera, *Fab.*, (Hunter's Cynthia).—Abundant on the Mountain, October 1850, (Billings).

Distribution.—Massachusetts, (Harris); Rochport, Ohio, (Kirtland).

Genus 6, Vanessa, *Fab.*

1. V. Atalanta, *Linn*, (Red Admiral).—Rare, though abundant at Sorel.
   Distribution.—Massachusetts, (Harris); Ohio, (Kirtland), (Eu.)
2. V. Antiopa, *Linn*, (Camberwell Beauty).—Extremely abundant, March to October.
   Distribution.—Massachusetts, (Harris); Ohio, (Kirtland); Southern shores of the Gulf; (Bell); Eastern Townships, (Gosse); (Eu.)
3. V. Milberti, *Godt.*; furcillata, *Say*, (Forked).—Common, May to September.
   Distribution.—Massachusetts, (Harris); Rockport, Ohio, (Kirtland); Eastern Townships, (Gosse); North-West-Territory, (Say); Rouge District.
4. V. J. album, *Boisd.*, (Compton Tortoise).—Common, Spring and Autumn.
   Distribution.—Rockport, Poland, Ohio, (Kirtland); Lake Superior, (Agassiz); Eastern Townships, (Gosse); Gaspé District, (R. Bell); Rouge District and Sorel.

Genus 7, Grapta, *Kirby.*

1. G. Progne, *Fab.*, (Green Comma).—Abundant, May to September.
   Distribution.—Rockport, Ohio, (Kirtland); Massachusetts, (Harris); Eastern Townships, (Gosse); Southern shores of the Gulf, (R. Bell); Rouge District
2. G. C. album, *Godt.*, (Orange Comma).—Not common.
   Distribution.—Eastern Townships, (Gosse); Rouge District.

Sub-Family IV. Argynnidi, *Steph.*

Genus 8, Argynnis, *Fab.*

1. A. Aphrodite, *Fab.*, (Silver-spot Fritillary).—Common, July to September.
   Distribution.—New York, (Emmons); Massachusetts, (Harris); Ohio, (Kirtland); Lake Superior, (Agassiz) Eastern Townships, (Gosse); South shores of the Gulf, (R. Bell); Niagara and Sorel.
2. A. Cybele, *Fab.*, (Great spangled Fritillary).—Not so common, Aug.
   Distribution.—Eastern Townships, (Gosse).

Genus 9, Melitœa, *Fab.*

1. M. Myrina, *Cramer*, (American Pearl-border Fritillary).—Not very common, June to August.
   Distribution.—As far South as Florida, and North as Massachusetts, (Say); Ohio, Wisconsin and Connecticut, (Kirtland); Lake Superior, (Agassiz); Eastern Townships, (Gosse); South side of the Gulf, (R. Bell); Rouge District.
2. M. Tharos, *Cramer*; Cocyta, *Hübner*, (Pearl-crescent Fritillary).—Very abundant, June to August.

Distribution.—Massachusetts, (Harris); Ohio, (Kirtland); Lake Superior, (Agassiz); Eastern Townships, (Gosse); South side of the Gulf, (R. Bell); Rouge District.

Family IV. LYCÆNIDÆ *Leach.*

Genus 1, Thecla, *Fab.*

1. T. Niphon? *Hübner.*—Sorel and perhaps Montreal, May: (several other species undetermined.)

Genus 2, Chrysophanus, *Hübner*; Lycæna, *Fab.*; Polyommatus, *Boisd.*;

1. C. Americana, *Harris*, (American Copper).—Common, August.
   Distribution.—Massachusetts, (Harris); Ohio, (Kirtland); Eastern Townships, (Gosse); Rouge District and Sorel.
2. C. Thoe? *Boisd.*—Lachine, (Barnston).
   Distribution.—Rockport, Ohio, (Kirtland).

Genus 3, Polyommatus, *Latr.*; Lycæna, *Boisd.*

1. P. pseudargiolus, *Boisd.*; Lucia, *Kirby*, (Spring Azure).—Not very common, May and June.
   Distribution.—Massachusetts, (Harris); Rockport, Ohio, (Kirtland); Eastern Townships, (Gosse); Latitude, 54° North, (Kirby); South side of the Gulf, (R. Bell); Rouge District.
2. P. Comyntas, *Godt.*—Lachine, (Barnston).
   Distribution.—Rockport, Ohio, (Kirtland).

Family V. HESPERIDÆ, *Leach.*

Genus 1, Eudamus, *Swains.*

1. E. Tityrus, *Fab.*; Clarus, *Cramer.*—Numerous, 1858, (Mr. Fowler).
   Distribution.—Massachusetts, (Harris); Ohio, (Kirtland).

Genus 2, Pamphila, *Fab.*

1. P. cernes, *Boisd.*, (Tawny-edged Skipper).—Not uncommon.
   Distribution.—Eastern Townships, (Gosse); and several undetermined species.

HETEROCERA, *Boisd.*

Group 1. SPHINGINA, *Stainton.*

Family I. SPHINGIDÆ, *Leach.*

Genus 1, Smerinthus, *Latr.*

1. S. geminatus, *Say*; cerisii, *Kirby*, (Twin-eyed Hawkmoth).—Not uncommon.
   Distribution.—Massachusetts, (Harris); Orillia, C.W., (Bush.); Eastern Townships (Gosse); Sorel.
2. S. myops, *Abbot & Smith.*—Rare.
   Distribution.—United States, (Doubleday).

Genus 2, Sphinx, *Linn.*

1. S. drupiferarum, *Abbot and Smith.*—Common, June and July.
   Distribution.—United States.

Genus 3, Deilephila, *Och.*

1. D. Galii, *Fab.*; Chamænerii, *Harris*; Intermedia, *Kirby*, var.; Sphinx Epilobii, *Harris*.—Abundant on Lilac Blossoms, June.

   Distribution.—New Hampshire, (B. M. C.); Lake Superior, (Agassiz); Massachusetts, (Harris); Orillia, C.W., (Bush); York Factory, Hudson's Bay Territories, (Dr. Rae); Sorel, (Eu.)

Family SESIIDÆ *Steph.*

Genus 1, Sesia, *Fab.*

1. S. Thisbe, *Fab.*; Pelasgus, *Cramer & Harris*; ruficaudis, *Kirby*, var. —Not uncommon, July and August; flies by day.

   Distribution.—New York, (Doubleday); Massachusetts (Harris); New Jersey, (Kirby); Orillia, C.W., (Bush.); Eastern Townships, (Gosse); Sorel.

2. S. diffinis, *Boisd.*—Not uncommon in gardens on hot days in July.

   Distribution.—United States, (Doubleday); Orillia, C.W., (Bush.); St. Martin's Falls, Albany River, Hudson's Bay, (G. Barnston); Sorel.

Family CASTNIIDÆ, *Swains*; AGARISTIADÆ, *Harris.*

Genus 1, Alypia, *Hübner.*

1. A. octomaculata, *Fab.*—Not very common, June, (August, Gosse). "The Canada *A. 8-maculata* differs generally from those of the United States, in having smaller spots and less distinct blue streaks in the fore-wings, and it has no trace of the basal spot in the hinder wings."—Walker, Brit. Mus. Cat. Lepid. Het., Part I, p. 60.

   Distribution.—Georgia, United States, and Nova Scotia, (B.M. C. at); Eastern Townships, (Gosse).

Group 2. BOMBYCINA, *Stainton.*

Family. HEPIALIDÆ, *Steph.*

Genus 1, Hepialus, *Fab.*

1. H. argenteomaculatus, *Harris.*—Not common, July.

   Distribution.—Massachusetts, (Harris); Lake Superior, (Agassiz) Eastern Townships, (Gosse): Sorel.

Family. ZEUZERIDÆ, *Boisd.*

Genus 1, Cossus, *Fab.*

1. C. plagiatus, *Walker.*—Rare, July.

   In 1857, Mr. T. R. Peale, of the United States Patent office, named this species *Cossus McMurtrici*, and informed me that it was common South of Pennsylvania, but rare in the Middle States."

Family. NOTODONTIDÆ, *Steph.*

Genus 1, Datana, *Walker*; Eumetopona, *Fitch.*

1. D. ministra, *Drury.*—Larvæ abundant in camps on trees, August and September.

Distribution.—New York, (Fitch); Georgia, (B.M.C. at.); Massachusetts, Harris).

Family. LIPARIDÆ, *Walker.*

Genus 1, Orgyia, *Steph.*

1. O. leucostigma, *Abbot & Smith.*—Common; end of August to October.

Distribution.—Georgia, (Abbot & Smith); Massachusetts, (Harris); New York, (Fitch); Nova Scotia, (Lt. Redman); Eastern Townships, (Gosse); Rouge District.

Family LITHOSIIDÆ, *Steph.*

Genus 1, Ctenucha, *Kirby.*

1. C. Latreillana, *Kirby.*—Numerous, flying by day, in July.

Distribution.—New Hampshire, Maine, Nova Scotia, (B.M.C. at.); Eastern Townships, (Gosse); L'Orignal and South side of the Gulf, (R. Bell); Sorel and Rouge District.

Genus 2, Lycomorpha, *Harris*; Glaucopus, *Wester.*

1. L. Pholus, *Fab.*—Abundant on flowers of *Solidago* in the day time, August.

Distribution.—New York (Emmons); Massachusetts, (Harris); Nova Scotia, (Redman).

Genus 3, Hypoprepia, *Hübner.*

1. H. fucosa, *Hübner.*—Rare, August.

Distribution.—Georgia, (E. Doubleday).

Genus 4, Crocota, *Hübner.*

1. C. brevicornis, *Walker.*—Abundant amongst ferns, and in open grassy places, on the Mountain, in July.

Distribution.—United States, (B.M.C at.); Rouge District.

Genus 5, Nudaria, *Haworth.*

1. N. mendica, *Walker.*—Common amongst Ferns, &c., on the Mountain, July.

Distribution.—Trenton's Falls, N.Y., (E. Doubleday); Nova Scotia, (Redman); Rouge District.

Family. CHELONIDÆ, *Guén.* (?)

Genus 1, Hypercompa, *Steph*; Callimorpha, *Latr.*, p.

1. H. Lecontei, *Boisd.*; Confinis and Contiqua, *Walker*; and Callimorpha militaris, *Harris*, are probably only varieties of this species.—Very numerous, on the Mountain, in July.

Distribution.—New York, (E. Doubleday); New England, (Harris); Rouge District.

Genus 2, Arctia, *Schr.*; Chelonia, *Latr.*

A. virgo, *Hübner*; Callimorpha Parthenice, *Kirby*, a variety?—Common, August.

Distribution.—New York and Nova Scotia, (B.M.C.); Massachusetts, (Harris); Eastern Townships (Gosse); Sorel.

A. Isabella, *Abbot & Smith.*—Larvæ very numerous, Autumn and Spring, May, June, and July.

Distribution.—Georgia, (B. M. C.); New York, (Emmons); Massachusetts, (Harris); Eastern Townships, (Gosse); L'Orignal, (R. Bell); Sorel.

Genus 3, Spilosoma, *Steph.*

1. S. acrea, *Drury.*—Abundant in June, Larvæ in August.

Distribution.—New York, (B. M. C.); Massachusetts, (Harris); Eastern Townships, (Gosse); Sorel.

2. S. Virginica, *Fab.*—Common, June and July.

Distribution.—Georgia, New York, and Nova Scotia, (B. M. C.); Hudson's Bay Territories, (Barnston); Massachusetts, (Harris). Eastern Townships, (Gosse); Sorel.

Genus 4, Halesidota, *Hübner*; Lophocampa, *Harris.*

1. H. tesselaris, *Abbot & Smith*, (Muff-Moth or Hickory Tussock).—Not very common, June.

Distribution.—Mexico, Venezuela, United States, (B.M.C.); Massachusetts, (Harris); Eastern Townships, (Gosse); Sorel.

2. H. caryæ, *Harris*, Annulifascia, *Walker.*—Common, larvæ very numerous, August and September.

Distribution.—Massachusetts, (Harris); New York, (Fitch); Sorel.

Family. BOMBYCIDÆ, *Dap.*

Genus 1, Clisiocampa, *Curtis.*

1. C. Americana, *Fab.*; Sylvatica, *Harris.*—The larvæ, which are extremely destructive to the foliage of the trees about Montreal in some years, are known as the "Montreal Blight." The Moth appears in July.

Distribution.—Virginia, (Abbot); New York, (Fitch).

NOTE.—C. Americana, *Harris*, is Phalæna Castrensis, *Abbot & Smith*, = Clisiocampa decipiens, *Walker*, (B.M.C. Lepid. Het. Part vi, p. 1448.) The latter name must stand, Americana having been applied to the foregoing species by Fabricius.

Family. SATURNIIDÆ, *Walker.*

Genus 1, Samia, *Hübner*; Hyalophora, *Duncan.*

1. S. Cecropia, *Linn.*—Not very common; much less numerous than formerly, June and July.

Distribution.—Massachusetts, (Harris); New York, (Emmons); Niagara, Toronto, Sorel, &c.

Genus 2, Telea, *Hübner.*

1. T. Polyphemus, *Fab.*—Abundant, June and July.

Distribution.—Brazil, (B.M.C.); Massachusetts, (Harris); New York, (Emmons); Eastern Township (Gosse); Rouge District.

Genus 3, Tropœa, *Hübner.*

1. T. Luna, *Linn.*—Rare, June.

Distribution.—Mexico, (B.M.C.); Massachusetts, (Harris); New York, (Emmons); Niagara, Sorel, &c.

Group 3. Noctuina, *Stainton.*

Division 1. Trifidæ, *Guénée.*

Sub-Division 1. Bombyciformes, *Guénée.*

Family. Cymatophoridæ, *Hen.-Schæff.*

Genus 1, Gonophora, *Bruand*; Thyatira, Ochs., &c., p.

1. G. scripta, *Gosse.*—Not very common, June and July.

Distribution.—New York, (E. Doubleday); Eastern Townships, (Gosse); Orillia, C.W., (Bush); Rouge District.

Genus 2, Thyatira, *Ochs.*

1. T. cymatophoroides, *Guén.*—Common, June and July.

Distribution.—New York, (E. Doubleday); Orilla, C.W., (Bush); Rouge District.

Genus 3, Leptina, *Guén.*

1. L. Doubledayi, *Guén.*—Rare.

Distribution.—Northern States, (E. Doubleday).

Family, Bombycoidæ, *Guén.*

Genus, 1. Balsa, *Walker M.S.S.*

" Balsa, N.G. *Mas.* Corpus gracile. Proboscis distincta. Palpi graciles, recti, subpilosi, oblique ascendentes; articulus 2 us. longus; 3 us. parvus, lanceolatus. Antennæ glabræ. Abdomen subcarinatum, apice compressum, alas posticas non superans. Pedes graciles, glabri; calcaria longa. Alæ latiusculæ, apice subrectangulatæ, costa vix convexa, margine exteriore subconvexa subobliquo."

" *Male.* Body slender. Proboscis distinct. Palpi slender, straight, slightly pilose, obliquely ascending a little higher than the head: second joint long: third minute, lanceolate. Antennæ simple, smooth. Abdomen slightly keeled not extending beyond the hinder wings; tip compressed, with a small apical tuft. Legs slender, smooth; hind tibiæ with four long spurs. Wings rather broad. Forewings nearly rectangular at the tips; exterior borde slightly convex and oblique; costa very slightly convex."

1. "B. obliquifera, *Mas.* Cinerea, æneo subtincta; thorax albidus, nigro fasciatus; alæ anticæ apud costam albidæ striga obliqua guttaque exteriore trigona costalibus nigris, lineis nonnullis indistinctis deviis nigricantibus dentatis aut denticulatis albido submarginatis, punctis marginalibus nigris."

Male. Cinereous, slightly tinged with æneous. Head, thorax and forewings along the costa whitish. Thorax with a narrow black angular band. Forewings with a black streak extending obliquely from the costa to the disk, and accompanied by a black costal triangular dot; three or four irregular indistinct dentate or denticulated blackish lines which are slightly whitish bordered; a row of black marginal points. Hindwings without marks above; underside with the discal point and the exterior line slightly brownish. Length of the body 4 lines; of the wings 12 lines." Walker, M.S.S.

Montreal, not common, July.

Genus 2. ACRONYCTA, *Ochs.*

1. A. leporina, Linn. Not common.
   Distribution. St. Martins' Falls, Albany River, Hudson's Bay, (Barnston). (Eu.)
2. A. innotata, Guén.—August.
   Distribution. Trenton Falls, New York, (E. Doubleday).
3. A. fasciata, *Barnston.*—One specimen bred from a larva found eating the red cones of the sumach (*Rhus typhina*), October, 2nd 1856.
   Distribution.—St. Martin's Falls, Albany River, Hudson's Bay, (Barnston.)
4. A. psi, *Linn.*—Taken ootreacle in July.
   Distribution.—New York (E. Doubleday). (Eu.)

Subdivision 2. GENUINÆ, *Guén.*

Family, LEUCANIDÆ, *Guén.*

Genus 1. Leucania, *Ochs.*

1. L. extranea, *Guén.*—Numerous on sumach blossoms, &c., beginning of July.
   Distribution.—South America (Darwin); Venezuela, West coast of America, Georgia and Florida (B.M.C.); Orillia, C. W. (Bush); occurs also in Nepaul, Java, Australia and New Zealand, (B.M.C.) (Eu.)
2. L. diffusa, *Walker.*—Abundant, beginning of August.
   Distribution.—Nova Scotia (Redman).

3. L. insueta, *Guén.*—Abundant on treacle and sumach blossoms, in July.
Distribution.—Florida and New York, (E. Doubleday); Nova Scotia, (Redman.)

4. L. straminea, *Weit.*—On treacle, beginning of July.
Distribution.—New York, (E. Doubleday), (Eu.)

Genus 2. NONAGRIA, *Ochs.*

1. N? intractabilis, *Walker*, *M.S.S.*, N. Sp. " *Fœm.* Albida cinerea, gracilis; palpi porrecti, extus nigricantes; caput sat superantes, articulo 3o. longo lanceolato; pedes breves, validi, sub testacei; alæ latiusculæ, non longæ, fusco nigroque conspersæ, lunulis marginalibus fuscis; anticæ testaceo subvariæ, lineis duabus albidis undulatis, valde indistinctis, orbiculari et reniformi albido marginatis."

" *Female.* Whitish cinereous, slender. Palpi porrect, extending rather far beyond the head, blackish exteriorly; 3rd joint lanceolate, full half the length of the 2nd. Abdomen testaceous at the tip. Legs slightly testaceous, short, robust; spurs short stout. Wings rather broad, not long, minutely brown-and-black speckled; a marginal line of brown lunules. Forewings partly and indistinctly testaceous, somewhat rounded at the tips, with two very indistinct undulating whitish lines; orbicular and reniform marks whitish bordered, the former oblong the latter transverse and rather narrow. Length of the body 3½ lines; of the wings 9 lines." Walker M.S.S.

Family, GLOTTULIDÆ, *Guén.*

Genus 1. EUDRYAS, *Boisd.*

1. E. grata, *Fab.*, Notodonta? grata *Harris.* (Animals and Plants of Massa).—Not common.
Distribution.—New York (Emmons); Massachusetts (Harris); Sorel.

Family, APAMIDÆ, *Guén.*

Sub-Family, GORTYNIDES, *Duponch.*

Genus 1. Hydræcia, *Guén.*

1. H. nictitans, *Linn.*—Common end of July and beginning of August.
Distribution.—New York, (Doubleday); Mass., (Sheppard); Albany River, Hudson's Bay, (G. Barnston); Nova Scotia, (Redman): (Eu.)

2. H. lorea, *Guén.*—Abundant especially on blossoms of *Asclepias cornuti* in July.
Distribution.—New York, (E. Doubleday.)

3. H. stramentosa, *Guén.*—On treacle beginning of October (but worn). *Distribution.*—New York, (E. Doubleday.)
4. H. ligata, *Walker M.S.S.* N. Sp.—Attracted by light, beginning of July.

" *Fœm.* Cinerea; palpi verticem paullo superantes; abdomen alas posticas superans; alæ linea subtus exteriore nigricante; anticæ roseo, suffusæ, fusco conspersæ et trilineatæ, lineata duplicata, 3 a flexa, orbiculari et reniformi distinctis albido marginatis, linea marginali venis que nigricantibus."

" *Female.* Cinereous. Palpi rising a little higher than the vertex; third joint lanceolate, not more than one fourth the length of the second. Abdomen extending rather beyond the hind wings. Wings slightly æneous-tinged, with an exterior blackish line beneath. Forewings mostly rose-tinged minutely brown-speckled, with three brown lines, basal line double, undulating, interior line undulating; exterior line oblique, bent in front; orbicular and reniform marks distinct, whitish-bordered, the former large and round, the latter of the usual form; marginal line and veins blackish. Length of the body 5 lines; of the wings 12 lines." Walker, M.S.S.

Genus 2. NEPHELODES, *Guén.*

1. N. signata, *Walker M.S.S.*, N. Sp.—Attracted by light, beginning of August.

" *Mas.* Rufescente cinerea, crassa; palpi caput vix superantes: antennæ subpectinatæ; abdomen alas posticas superans; tibiæ posticæ pilosissime; alæ anticæ lineis quinque undulatis nigris, litura reniformi magna alba ferrugineo varia; posticæ æneo-cinereæ, litura discali lineaque exteriore subtus nigris."

Male. Reddish cinereous, very robust. Palpi vertical, hardly rising higher than the head; 3rd joint lanceolate, minute. Antennæ slightly pectinated. Abdomen extending rather beyond the hind-wings; apical tuft rosy, large, quadrate. Legs stout; hind tibiæ very pilose; spurs moderately long. Forewings with five slight undulating black lines, and with a large white ferruginous, varied reniform mark; underside with a distinct exterior black line. Hind wings æneous-cinereous; underside with the discal mark and the exterior line black and very distinct. Length of the body 8 lines; of the wings 14 lines." Walker M.S.S.

2. N. minians, *Guén.*—On the Mountain, beginning of September.
Distribution.—New York, (Doubleday); Nova Scotia, (Redman); Orillia, C.W. (Bush.)

Sub-Family, Xylophasides, *Guén.*

Genus 3. Xylophasia, *Steph.*

1. X. lignicolora, *Guén.*—Very abundant, July and beginning of August.
Distribution.—New York, (Doubleday); Nova Scotia, (Redman).
2. X. lateritia, *Esp.*—Very abundant, July.
Distribution.—Nova Scotia, (Redman); Newfoundland, (B.M.C.) (Eu).
3. X. indocilis, *Walker.*—July.
Distribution.—New York, (Doubleday); Massachusetts, (Prof. Sheppard.)

Sub-Family, Apamides, *Guén.*

Genus 4. Crymodes, *Guén.*

1. C. gelida? *Guén.*—End of August.
Distribution.—Arctic America? (B.M.C.)

Genus 5. Mamestra, *Ochs.*

1. M. Arctica, *Boisd.*, Hadena Amica, *Steph*, (Vide Emmons, Agri., N. Y., M. plate 45, fig. 2.)—Very abundant, July.
Distribution.—New York, (Doubleday); Mass., (Sheppard); Lake Superior, (Agassiz); Nova Scotia, (Redman); Orillia, C. W., (Bush.)
2. M. brassicæ, *Linn.*—Common, June and July.
Distribution.—Orillia, C. W., (Bush; (Eu).
3. M. dubitans, *Walker.*—July and August.
Distribution.—Trenton Falls, New York, (E. Doubleday); Nova Scotia, (Lt. Redman).
4. M. ordinaria, *Walker.*—Very abundant, July and August.
Distribution.—Trenton Falls, New York, (E. Doubleday.)
5. M. unicolor, *Walker.*—July.
Distribution.—Trenton Falls, New York, (E. Doubleday); St. Martin's Falls, Albany River, Hudson's Bay, (G. Barnston); Nova Scotia, (Redman).

Genus 6. Apamea, *Ochs.*

1. A. finitima, *Guén.*—Beginning of June and July.
Distribution.—New York, (E. Doubleday).
2. A. insignata, *Walker* M.S.S., N. Sp.—Beginning of July.

" *Fœm.* Fusca; palpi oblique ascendentes; abdomen subcristatum, alas posticas superans; alæ lineis pallidis indistinctis undulatis, orbiculari et reniformi distinctis albido marginatis, hujus disco albido striga ochracea intersecto."

"*Female.* Brown, cinereous beneath. Palpi obliquely ascending; third joint conical, less than one-fourth of the length of the second, abdomen slightly crested, extending beyond the hind wings; tip tawny. Forewings with indistinct undulating pale lines, and with whitish-bordered distinct orbicular and reniform marks; orbicular mark oblique; reniform mark incomplete, bordered, its disk mostly whitish and traversed by an ochraceous streak which extends far beyond it; three whitish costal subapical points. Length of the body 8 lines; of the wings 20 lines."

3. A. glaucovaria, *Walker* M.S.S., N. Sp.

"*Mas.* Cinerea; palpi oblique ascendentes; abdomen cristatum; alæ anticæ cervino subtinctæ, glauco notatæ, lineis nigricantibus deviis undulatis, linea submarginali cuneata, lunulis marginalibus guttisque costalibus nigris; posticæ pisco late marginatæ."

"*Male.* Cinereous. Palpi obliquely ascending; third joint very short, not more than one-sixth of the length of the second. Abdomen crested. Forewings slightly tinged with fawn-colour, marked here and there with glaucous, which hue most prevalent on the large reniform mark; lines blackish, irregular, undulating; submarginal line with uniform angles; marginal lunules and costal dots black; orbicular mark large, oblique, short-oval. Hind-wings with a broad brown border; fringe whitish; underside with the discal mark and the submarginal line brownish. Length of the body 7 lines; of the wings 14 lines." *Walker M.S.S.*

3. A. modica, *Guén.*—July.
Distribution.—New York, (Doubleday).

Genus 7. Miana, *Steph.*

4. M. undulifera, *Walker.*—Rare, July.
Distribution.—St. John's Bluffs, East Florida, (Doubleday).

Genus 8. Celæna, *Steph.*

1. C ? contrahens, *Walker M.S.S.*, N. Sp.—Common, July.

"*Mas.* Pallide cinereo-cervina; abdomen albidum; alæ lunulis marginalibus fuscis; anticæ lineis tribus pallidis nigricante marginatis, 1 a 2 a que undulatis, 3 a flexa, orbiculari et reniformi pallido marginatis; postice albidæ, margine cinereo diffuso."

"*Male.* Pale cinereous fawn-colour. Palpi obliquely ascending; third joint lanceolate, less than half the length of the second.

Abdomen and underside whitish. Wings with a marginal line of brown lunules. Forewings with the basal, interior and exterior lines pale, blackish bordered; first and second undulating; third bent; orbicular and reniform marks partly pale-bordered, not distinct; costa with three pale points towards the tip; underside with a blackish discal mark and a blackish exterior line. Hindwings white, diffusedly cinereous-bordered; underside like that of the forewings. Length of the body 5 lines; of the wings 12 lines." *Walker M.S.S.*

2. C? velata, *Walker* M.S.S., N. Sp.—July.

" *Fœm.* Ferruginea; abdomen subcarinatum; alæ cupreo subtinctæ; anticæ lineis quatuor indistinctis nigricantibus, 1 a 2 a que undulatis, 3 a 4 a que denticulatis, orbiculari et reniformi parvis, hac alba; posticæ cinereæ."

" *Female.* Ferruginous, cinereous beneath. Palpi obliquely ascending rising a little higher than the vertex; third joint lanceolate, less than half the length of the second. Abdomen slightly keeled. Wings with a slight cupreous tinge. Forewings with four indistinct blackish lines; first and second lines undulating; third and fourth denticulated; marginal line very indistinct; orbicular and reniform marks small, the former cinereous and indistinct, the latter white; underside with the usual discal mark and exterior line blackish. Hindwings cinereous. Length of the body 5 lines, of the wings 12 lines." *Walker M.S.S.*

Family, NOCTUIDÆ, *Guén.*

(*Cut-worms* are larvæ of moths of this family.)

Genus 1. AGROTIS, *Ochs.*

1. A. suffusa, W. Verz.—On treacle, beginning of October.
   Distribution.—Philadelphia (E. Doubleday); Orillia, C. W., (Bush); St. Martin's Falls, Albany River, Hudson's Bay, (D. Barnston); Nova Scotia, (Redman), (Eu. and every part of the world).
2. A. spissa, *Guén.*—Common, July to September.
   Distribution.—United States, (Doubleday); Nova Scotia, (Redman.)
3. A. jaculifera, *Guén.*—Common, July and August.
   Distribution.—New York, (B.M.C.)

. A. venerabilis, *Walker.*—Common, sitting on blossoms of the Goldenrod by day in September.
   Distribution.—Nova Scotia, (Redman.)

5. A. illata, *Walker.*
Distribution.—Unknown.
6. A. obelisca, *Wien. Verz.*—End of July.
Distribution.—Nova Scotia, (Redman). (Eu.)

Genus 2. Graphiphora, *Ochs.*

1. G. Augur, *Fabr.*—End of July.
Distribution.—New York, (Doubleday) ; St. Martin's Falls Albany River, Hudson's Bay, (Barnston). (Eu.)
2. G. Baja, *Wien. Verz.*—August.
Distribution.—Rio Janeiro, (B. M. C.) ; New York, (Doubleday) ; Orillia, C.W., (Bush.) (Eu.)

Genus 3. Ochropleura, *Hübn.*

1. O. plecta, *Linn.*—Not uncommon.
Distribution.—New York, (Doubleday) ; Nova Scotia, (Redman). (Eu.)

Family, Orthosidæ, *Guén.*

Genus 1. Xanthia, *Ochs.*

1. X. ferruginea, *Wien. Verz.*—Common, September and beginning of October.
Distribution.—Unknown to me. (Eu.)

Genus 2. Cirrœdia, *Guén.*

1. C. pampina, *Guén.*—Not common, beginning of September.
Distribution.—New York, (B. M. C.) ; Nova Scotia, (Redman.)

Family, Hadenidœ, *Guén.*

Genus 1. Euplexia, *Steph.*

1. E. lucipara, *Linn.*—June and July.
Distribution.—New York, (Doubleday) ; Rouge District, (Eu.)

Genus 2. Eurois, *Hübn.*

1. E. imbrifera, *Guén.*—July.
Distribution.—New York, (Doubleday) ; Orillia, C.W., (Bush.)

Family, Xylinidœ, *Guén.*

Genus 1. Calocampa, *Steph.*

1. C. vetusta, *Hübn.*—Taken on Treacle, beginning of October.
Distribution.—Mass. : (Prof. Shepard) ; Orillia, C. W., (Bush.) ; St. Martin's Falls, Albany River, Hudson's Bay, (Dr. Barnston). (Eu.)

Genus 2. Cucullia, *Ochs.*

1. C. chamomillæ, *Men. Verz.*—June.
Distribution.—New York, (E. Doubleday); St. Martin's Falls, Albany River, Hudson's Bay, (Dr. Barnston) (Eu.)
2. C. florea, *Guén.*
Distribution.—New York, (E. Doubleday).

Sub-division 3. MINORES, *Guén.*
Family, ERASTRIDÆ, *Guén.*

Genus 1. ERASTRIA, *Ochs.*

1. E. carneola, *Guén.*—Rare, beginning of August.
Distribution.—United States, (E. Doubleday).

Division 2.—QUADRIFIDEA, *Guén.*

Tribe, VARIEGATÆ, *Guén.*

Family, PLUSIDÆ, *Boisd.*

Genus 1. PLUSIA, *Ochs.*

1. P. ærea, *Hübn.*—July and August.
Distribution.—New York and Florida, (Doubleday); Nova Scotia, (Redman); Orillia, C.W., (Bush).
2. P. precationis, *Guén.*—Common, August.
Distribution.—New York and Philadelphia, (Doubleday); Mass.: (Prof. Shepard); Orillia, C.W., (Bush).
3. P. mortuorum, *Guén.*—Common, August.
Distribution.—New York, (Doubleday); Orillia, C.W., (Bush); Sorel and Rouge District.

Tribe, INTRUSÆ, *Guén.*

Family, AMPHIPYRIDÆ, *Guén.*

Genus 1, AMPHIPYRA, *Ochs.*

1. A. pyramidoides, *Guén.*—Common in August on the Mountain.
Distribution.—Massachusetts. (Harris).
2. A. tragogoponis, *Linn.*—Abundant, beginning of August.
Distribution.—L Orignal on the Ottawa, (R. Bell). (Eu).

Tribe, EXTENSÆ, *Guén.*

Family, HOMOPTERIDÆ, *Guén.*

Genus 1, HOMOPTERA, *Boisd.*

1. H. lunata, *Drury.*—Taken on Treacle in May.
Distribution.—Massachusetts, (Harris); St. Domingo, (B.M.C.)
2. H. contracta, *Walker, M.S.S.* N. Sp.—Middle of July.

"*Fœm.* Ferrugineo fusca; palpi arcuati, graciles, ascendentes; alæ lineis nigris undulatis, linea interiore duplicata strigam nigram includente, linea media dentata apud costam dilatata, linea exteriore pallido marginata; anticæ lineis duabus basalibus."

"*Female.* Ferruginous brown, cinereous beneath. Palpi curved, slender, obliquely ascending, rising higher than the head; third joint lanceoate, about half the length of the second. Wings with black undulating lines; interior line double, the intervening space partly black; middle line dentate, much dilated on the

costa; exterior line pale-bordered; marginal points black. Forewings with two basal lines. Length of the body 4 lines; of the wings, 11 lines." *Walker M.S.S.*

3. H. Herminioides, *Walker, M.S.S. N. sp.*.—July.

"*Fœm.* Albido cinerea, gracilis; palpi gracillimi; alæ lineis quatuor angulosis, duabus nigris bene determinatis duabusque cinereis indistinctis, fimbria nigricante punctata; anticæ orbiculari et reniformi nigris."

Female. Whitish cinereous, slender. Palpi very slender, rising higher than the vertex; third joint lanceolate, full half the length of the second. Wings with four zigzag lines; interior and exterior lines black, much more distinct than the other two which are cinereous; fringe with blackish points. Forewings with black orbicular and reniform marks, the former small, the latter large, full. Length of the body 4 lines; of the wings 10 lines." *Walker, M.S.S.*

Tribe, Limbatæ, *Guén.*

Family, Catocalidæ, *Boisd.*

Genus 1. Catocala, *Schr.*

1. C. amatrix *Hübn.*—Abundant in Poplar trees, beginning of October.
   Distribution.—United States (Doubleday); Nova Scotia (Redman); Orillia, C. W., (Bush); Sorel.
2. C. concumbens, *Walker.*—Not common, August.
   Distribution.—Orillia, C. W. (Bush); Sorel.
3. C. cerogama, *Guén.*—Flying from tree to tree in September, by day on the Mountain.
   Distribution.—Trenton Falls, New York, (Doubleday); Orillia, C.W., (Bush).
4. C. polygama, *Guén.*—Attracted by light in July.
   Distribution.—Orillia, C. W., (Bush); Sorel.

Tribe, Serpentinæ, *Guén.*

Family, Euclididæ, *Guén.*

Genus 1. Drasteria, *Hübn.*

1. D. Erechtea, *Hübn.*—Very abundant in grass fields, July to September.
   Distribution.—New York and Illinois (Doubleday); Massa: (Harris); Nova Scotia (Redman); St. Martins' Falls, Albany River, Hudson's Bay (Dr. Barnston).

"The Hudson's Bay specimens are hardly more than half the size of those from New York" Walker, Brit. Mus. Cat. Lepid. Het. XIV, p. 1457.

Group 4. Geometrina, *Stainton.*

Family, Ourapterydæ, *Guén.*

Genus 1. Chærodes, *Guén.* Crociphora, *Harris.*

1. C. transposita, *Walker.*—End of August.
2. C. transversata, *Drury.*—Beginning of August.

Distribution.—Massachusetts (Harris); Lake Superior (Agassiz).

Family, Ennomidæ, *Guén.*

Genus 1. Angerona, *Dup.*

1. A. crocataria, *Fab.*—Common beginning of July.

Distribution.—Sorel and Rouge District.

Genus 2. Endropia, *Guén.*

1. E. effecta, *Walker, M.S.S. N. sp.*—Beginning of July.

" *Mas.* Ferruginea, cinereo varia; alæ lineis interiore et exteriore obliquis subdenticulatis obscure ferrugineis, illa costam versus flexa, linea media diffusa indistincta; anticæ subfalcatæ, margine exteriore flexo subexcavato; posticæ gutta discali nigra, margine exteriore valde inciso."

" *Male.* Ferruginous varied with pale cinereous, the latter hue most prevalent towards the base of the wings and along the costa of the forewings. Wings with the interior and exterior lines dark ferruginous, oblique, slightly denticulate; interior line bent towards the costa; middle line diffuse indistinct; underside with the middle and exterior lines very distinct. Forewings subfulcate; exterior border distinctly bent, slightly excavated. Hind wings with a black discal dot, exterior border much notched. Length of the body 9 lines; of the wings 20 lines." *Walker, M.S.S.*

2. E. refractaria, *Guén.*—August and September.

Distribution.—Rouge District.

Genus 3. Ellopia, *Treit.*

1. E. floridaria, *Guén.*—Common in long grass, sides of the Mountain, July.
2. E. annisaria, *Walker, M.S.S. N. sp.*—Very abundant in July.

Mas. et *Fœm.* Pallide citrina; alæ subtus macula discali; linea submarginali maculari strigisque paucis fuscis; anticæ gutta discali maculisque duabus submarginalibus fuscis."

" *Male* and *Female.* Pale lemon colour. Head and forepart of the thorax brighter. Wings beneath with a few transverse brown speckles, with a brown discal spot, and a submarginal line composed of brown spots; this line very incomplete in the forewings. Forewings with a brown discal dot which is much

smaller than that on the under side, and with two brown spots which indicate the submarginal line. Hind wings not marked above. Length of the body 6 lines; of the wings, 15 lines." *Walker, M.S.S.* Larva supposed to feed on the species of currant (*Ribes*). Pupa under the bark of dead stumps, &c.

Genus 4. Ennomos, *Treit.*

1. E. subsignaria, *Hübner.*—Isle Jesus, July.

Family, Amphidasidæ, *Guén.*

Genus 1. Biston, *Leach.*

1. B. ursaria, *Walker, M.S.S. N. sp.*—Common near and in the city, end of April.

"*Mas.* Obscure cinerea, crassa pilosissima, nigro conspersa; antennæ latissime pectinatæ; pedes dense fasciculati; alæ anticæ lineis quatuor obliquis nigris, 1 a flexa, 2 a, 3 a que approximatis subundulatis, 4 a diffusa; posticæ linea 1 a, obsoleta, 4 a e striga brevi lata postica."

"*Male.* Dark cinerous, speckled with black, very robust and pilose. Antennæ very broadly pectinated. Thorax with three black bands. Legs densely tufted. Forewings with four black oblique lines; first line bent; second and third approximate, slightly undulating, diverging towards the costa; fourth diffuse. Hindwings with the first line obsolete; second and third apparent; fourth indicated by a short broad streak near the interior angle. Length of the body, 8-9 lines, of the wings, 22-24 lines." *Walker, M.S.S.*

Family, Boarmidæ, *Guén.*

Genus 1. Boarmia, *Steph.*

1. B. cunearia, *Walker.*—Woods on the Mountain, May.
   Distribution.—Rouge District.

Family, Geometridæ, *Guén.*

Genus 1. Aplodes, *Guén.*

1. A. mimosaria, *Guén.*—Not uncommon on the Mountain in May.

Family, Acidalidæ, *Steph.*

Genus 1. Acidalia, *Treit.*

1. A. inductata *Guén.*—Middle of July.
2. A. similaria, *Walker, M.S.S. N. sp.*

"*Mas.* Alba; caput, thorax et abdomen basi subtestacea; alæ lineis duabus testaceis punctularibus indeterminatis: anticæ basi testaceæ."

"*Male.* White head, thorax and base of abdomen somewhat testaceous. Wings speckled with testaceous, which hue forms two incomplete and very slight lines. Forewings with the speckles more numerous than those of the hindwings; the base wholly testaceous. Length of the body, 5 lines; of the wings, 12 lines.' *Walker, M.S.S.*

3. A. anticaria, *Walker, M.S.S. N. sp.*—Common, August.

"*Mas.* Testaceo-cinerea; caput albido fasciatum, antice nigrum. Antennæ pubescentes; alæ nigro subconspersæ, puncto discali nigro, lineis tribus vix undulatis valde indistinctis, linea tenui nigricante, linea marginali nigra perangusta."

Male. Testaceous-cinereous. Head black in front; vertex with a whitish band. Antennæ whitish, pubescent. Wings very minutely black speckled, discal point black; three very indistinct hardly undulating lines which are very little darker than the ground hue; a slight blackish line between the second and third lines; marginal line black, very slender, interrupted by the veins. Length of the body $3\frac{1}{2}$ lines; of the wings, 9 lines. *Walker, M.S.S.*

Genus 2. Pellonia, *Dup.*

1. P. successaria, *Walker, M.S.S. N. sp.*—Common, end of July.

"*Mas.* et *Fœm.* Pallide lutea; palpi porrecti, brevissimi, gracillimi; alæ subconspersæ, fasciis duabus margineque exteriore purpurascente roseis; anticæ acutæ, litura discali purpurascente rosea sat magna."

"*Male* and *Female.* Pale luteous. Palpi porrect, very short and slender, hardly extending beyond the head. Wings slightly speckled, with two bands and the exterior border purplish rosy. Forewings acute; the two bands more or less confluent, discal mark purplish rosy, rather large. *Male,* Antennæ minutely pubescent. Length of the body 4 lines; of the wings 11 to 12 lines." *Walker, M.S.S.*

Family, Fidonidæ, *Guén.*

Genus 1. Lozogramma, *Steph.*

1. L. subæquaria, *Walker, M.S.S. N. sp.*—Abundant in May.

Distribution.—Sorel, St. Hilaire and Laprairie.

"*Fœm.* Albido-cinerea, ochraceo subtincta, nigricante conspersa; tibiæ postice subincrassatæ; alæ linea marginali tenui fusca, fimbria fusco interlineata; anticæ acutæ, lineis duabus obliquis albidis intus fusco marginatis.

"*Female.* Whitish cinereous, minutely blackish-speckled, slightly ochraceous tinged. Hind tibia slightly incrassated. Wings with a slender brown marginal line; fringe interlined with brown. Forewings acute, with two oblique whitish lines which are diffusedly brown-bordered on the inner side; interior line straight; exterior line very slightly undulating. Length of the body 5½ lines; of the wings, 16 lines." *Walker, M.S.S.*

Genus 2. Numeria, *Dup.*

1. N. inceptaria, *Walker. M.S.S. N. sp.*

"*Mas.* Cinerea, gracilis, fusco conspersa; antennæ pectinatæ; alæ linea marginali tenui nigricante; anticæ vix acute lineis duabus nigricantibus undulatis subobliquis, linea submarginali fusca diffusa indistincta, lunula discali parva nigricante."

"*Male.* Cinereous, slender, minutely brown speckled. Antennæ rather broadly pectinated. Wings with a slender blackish marginal line. Forewings hardly acute, with two slight oblique undulating blackish lines and with a diffuse and indistinct submarginal brown line; discal lunule small, blackish. Hindwings with two somewhat diffuse brown lines. Length of the body, 5 lines; of the wings, 12 lines." *Walker, M.S.S.*

Family, Hybernidæ, *Guén.*

Genus 1. Hybernia, *Latr.*

1. H. defoliaria, *Linn.*—Very abundant on the Mountain at the end of October, and beginning of November, on mild evenings. (Eu).

Genus 2. Anisopteryx, *Steph.*

1. A. restituens, *Walker, M.S.S. N. sp.*—Abundant in woods near Montreal at the end of October.

"*Mas.* obscure cinerea; antennæ vix pectinatæ; abdomen subflavescens; alæ cinereæ, litura, discali tenui nigricante, punctis marginalibus nigris; antica lineis duabus obscure cinereis indistinctis undulatis albido-marginatis, costa obscure cinerea."

"*Male.* Dark cinereous. Antennæ very slightly pectinated. Abdomen with a yellowish tinge. Wings cinereous with a slight blackish discal mark and with black marginal points. Forewings with two indistinct undulating dark cinereous whitish-bordered lines; costa dark cinereous. Length of the body 5 lines; of the wings, 14 lines." *Walker, M.S.S.*

Family, Larentidæ, *Guén.*

Genus 1. Cheimatobia, *Steph.*

1. C. boreata, *Hübn.*—Very numerous in woods at St. Hilaire and Belœil Mountain, in November. (Eu).

Genus 2. Melanippe, *Dup.*

1. M. Gothicata, *Guén.*—Common, June.
   Distribution.—Rouge District, Sorel and Southern shores of the gulf.
2. M. lacustrata, *Guén.*—Abundant, May and August.
3. M. intermediata, *Guén.*—Common, May, July and August.

Genus 3. Coremia, *Guén.*

1. C. propugnata, *Meir. Verz.*—August. (Eu).

Genus 4. Scotosia, *Steph.*

1. S. undulata, *Linn.*—Common, June and July. (Eu).
   Distribution.—Massachusetts, (Harris); Rouge District.
2. S. affirmaria, *Walker, M.S.S. N. sp.*—Abundant in August.

"*Mas.* Rufo-cinerea; thorax nigro fasciatus; alæ anticæ lineis plurimis rufescentibus subundulatis, lineis tribus distinctis dentatis nigris, linea submarginali elunulis albidis, litura discali nigra obliqua minima."

"*Male.* Cinereous. Body above and forewings much tinged with red. Thorax with a black band. Wings with a black marginal festoon. Forewings with many slight undulating reddish lines, with three distinct dentated black lines, and with a whitish submarginal line which is composed of lunules; discal mark black, oblique, very small. Hindwings pale cinereous, with several indistinct darker lines and with a reddish tinge about the interior border and the exterior border. Length of the body, 8 lines; of the wings, 18 lines." *Walker, M.S.S.*

Group 5. PYRALIDINA, *Stainton.*

Sub. group 1. Pyralides, *Guén.*

Section 1. Deltoides, *Guén.*

Family, Hypenidæ, *Guén.*

Genus 1. Hypena, *Schr.*

1. H. *N. sp.*—Abundant flying by day on the Mountain, May to July.
2. H. cæcalis, *Walker.*—May.

Genus 2. Hormissa.

1. H. effusalis, *Walker, M.S.S.*—Common in July.

"*Mas.* Cerrino-cinerea; palpi decumbentes, longissimi articulo 2o. apicem versus arcuato, 3o. lanceolato; antennæ pectinatæ; alæ anticæ lineis tribus fuscescentibus subundulatis, linea marginali fusca tenui, reniformi e striga angusta arcuata; posticæ striga latissima, lineis indistinctis."

"*Male.* Cinereous, with a slight fawn coloured tinge. Palpi decumbent, very long; 2d. joint much curved towards the tip;

3rd. lanceolate, full half the length of the second. Antennæ rather broadly pectinated. Legs smooth; spurs very long. Forewings with three slightly undulating brownish lines, the middle one somewhat bent; marginal line brown slender; reniform mark indicated by a curved slender streak. Hindwings much paler than the forewings, with the exception of a very broad streak; lines much less distinct. Length of the body $3\frac{1}{2}$ lines; of the wings 9 lines." *Walker*, *M.S.S.*

Family, Herminidæ, *Guén.*

Genus 1. Bleptina, *Guén.* (?)

3. B. surrectalis, *Walker.*—Common in August.
   Distribution.—Rouge District.

Genus 2. Herminia, *Latr.*

1. H. cruralis, *Guén.*—Abundant in grassy places, July.
2. H. concisa, *Walker, M.S.S. N. sp.*—Common, July.

"*Mas.* et *Fœm.* Cinerea; palpi arcuati, glabri, erecti articulo 3o. lanceolato; antennæ maris pubescentes; pedes simplices; alæ lineis tribus denticulatis nigricantibus, linea submarginali albida denticulata, lunulis marginalibus nigris; anticæ orbiculari et reniformi pallide flavescentibus, hac interlineata."

"*Male* and *Female.* Cinereous. Pulpi curved, smooth vertical; third joint lanceolate, more than half the length of the second. Antennæ of the male pubescent. Legs simple. Wings with three denticulated blackish lines and with one denticulated submarginal whitish line; marginal lunules black. Forewings with the orbicular and reniform marks pale yellowish and of the usual form, the latter traversed by a black line. Hindwings much paler than the forewings and with the lines less distinct. Length of the body 4 lines; of the wings 10 lines." *Walker*, *M.S.S.*

3. H. clitosalis, *Walker*, (H. cloniosalis, *Walker*).—Abundant amongst ferns, &c., on the Mountain in July.

Genus 3. Epizeuxis, *Hübner.*

1. E. gaosalis, *Walker.*—Abundant in grassy places, in July.

Section 2. Pyralites, *Guén.*

Tribe, Pulvurulentæ, *Guén.*

Family, Pyralidæ, *Guén.*

Genus 1. Pyralis, *Linn.*

1. P. farinalis, *Linn*, (Meal Moth).—Common in houses, June an July.
   Distribution.—Massachusetts, (Harris). (Eu).

Tribe, Luridæ, *Guén.*

Family, Ennychidæ, *Guén.*

Genus 1. Ennychia, *Treit.* Anania, *Hübn.*

1. E. octomaculata, *Linn.*—June and July.
   Distribution.—Lake Superior, (Agassiz); Rouge District. (Eu.)

Family, Hydrocampidæ, *Guén.*

Genus 1. Cataclysta, *Hübn.*

1. C. laminalis, *Walker.*—Very abundant, flying in the afternoon over flowers in gardens &c., beginning of August.

Family, Botydæ, *Guén.*

Genus 1. Botys, *Latr.*

1. B. verticalis, *Linn.*—Common July.
   Distribution.—Rouge District. (Eu).

The following new species of *Geometrina* taken at Sorel, probably occurs also at Montreal.

Family, Macaridæ, *Guén.*

Genus 1.—Macaria, *Curtis.*

1. M. spilosaria, *Walker, M.S.S.*—In firwoods, May.

"*Fœm.* Fusca; palpi brevissimi; thorax nigro fasciatus; abdominis segmenta albido marginata: pedes nigricantes, tarsis albido fasciatis; alæ anticæ cinereæ, extus fuscascentes, fasciis duabus fuscis, subundulatus nigro marginatis, linea exteriore nigra denticulata subundulata, linea submarginali, e lunulis albis, linea marginali e punctis elongatis nigris."

"*Female.* Brown. Palpi very short. Thorax with a black band in front. Abdomen with the hind borders of the segments whitish. Legs blackish; tarsi with whitish bands. Forewings cinereous, with the exterior part brownish; two brown slightly undulating black-bordered bands; first band basal; second interior; a denticulated slightly undulating exterior black line, followed by an incomplete line of white lunules; marginal line composed of elongated black points. Hind wings cinereous, with the lines very slightly marked. Length of the body 5 lines; of the wings 14 lines." *Walker, M.S.S.*

June 4th, 1860. Exeter, Devonshire.

ARTICLE XXXVIII.—*Abridged Sketch of the life of Mr. David Douglas, Botanist, with a few details of his travels and discoveries.*

(*Continued from last Number.*)

On his arrival in London late in autumn, his welcome among his friends was of the warmest and most gratifying description. The exhibition of his discoveries at the meetings of the Horticultural Society, and the notices of his new contributions in the various branches of Natural History, in the respective scientific periodicals, raised his name, and soothed his feelings on the steep and thorny ascent to high reputation. In time these flattering sensations, as is usual with ardent dispositions, lost their glow, and he felt that he could not rest on his laurels; the only benefit reaped from them was an extensive acquaintance and the thorough conviction in his own mind that his field of duty lay not at home, but amongst the unexplored riches of the soil, in foreign lands. His most attached and valuable friends were of the same opinion. Amongst these might be reckoned Capt., afterwards Col. Sabine, who kindly took Douglas under his own particular instructions and patronage, so that the latter was soon taught the use of astronomical instruments and became a most accurate observer.

Looking forward with sanguine expectation to a brilliant course now opening up before him, the comforts of home and pleasures of london society were abandoned, and Douglas again embarked for the Columbia, refreshed and strengthened for a still brighter career. During the interval he had benefited greatly by the society of his inestimable friend Hooker, and both Mr. Sabine and his brother Capt. Sabine had shewn him special marks of regard. At the suggestion of the latter the Colonial Office supplied him with an excellent set of instruments of various descriptions, so that the result of his investigations might be rendered important and useful, and his time be profitably occupied. His endowments of disposition and mind fully enabled him to make the most of these advantages and to bring into play the knowledge he had acquired, as opportunities might offer themselves to him. After an eight month's voyage he again set foot on the shores of the Columbia, where he had many a warm greeting. We were glad to see again amongst us an old friend, with his noble countenance, and agreeable hearty manner unchanged, and pleased to find that his stature as a disciple of science had greatly increased.

From the 3rd of June 1830, the date of his arrival, until the period of the leaving of the loaded boats for the interior, his time was occupied in unpacking his boxes, in the adjustment and trial of his instruments, and the determination of the position of Fort Vancouver, but during his leisure hours we had the enjoyment of his enlivening society.

Lewis and Clarke's Fork being a place of some note as the point of confluence of the two great branches of the Columbia, the North and the South, Mr. D. desired to adopt it as one of his principal stations for astronomical and magnetical observations. I therefore had the pleasure of his company up to Wallawalla, to the charge of which post I had been appointed. On the route, whenever an opportunity offered we were on shore together, and I was much surprised to remark the quickness of sight he displayed in the discovery of any small object or plant on the ground over which we passed. When in the boats, as they proceeded along, he would frequently spring up abruptly in an excited manner, and with extended arms keep his finger pointed at a particular spot on the beach or the shelving and precipitous rocks, where some new or desirable plant had attracted his notice. This was the signal to put on shore, and we would then be amused with the agility of his leap to the land, and the scramble like that of a cat upon the rocks to the object he wished to obtain, happy if he achieved this without slipping, and falling into the deep water alongside the boat.

The boats being got rid of at Wallawalla he was immediately busied in taking observations, and in that portion of the Columbia, there being scarcely ever a cloud or speck upon the sky his astronomical work advanced surely and rapidly. The regularity of barometrical and magnetical figurings was conspicuous, and the diurnal variations of temperature remarkably equal, the humidity of the atmosphere generally a mere trifle. The apparatus employed was of the most select kind of that day. Even the famous Arago had furnished approved asbestus thread for suspending the magnetic bars, and the zealous and persevering observer applied to every operation the utmost of his care and skill. To enable him again to visit the Blue Mountains, the heights of which range he wished to ascertain and the distribution of plants at various altitudes along its slopes, I furnished him with five horses, and our interpreter with a sturdy boy. After a few days absence on this excursion he returned, having accomplished all that he had

expected, yet regretting that the wild disposition of the Shoshonces, and our slender acquaintance with them, prevented his penetrating further to the southward within their bounds. To have attempted that would have been attended with great risk and danger. At this time we adopted a very successful mode of catching lizards; Indian boys were employed to beat about for the game armed with single horse-hair lassos, tied to the end of a wand. It was laughable to see the little urchins, naked as they were born, scouring about, and when they discovered a hole, throwing themselves flat on the heated sand, and extending the small noose over the entry to the reptile's apartment. Where their victim shewed his head, they would then quickly suspend him with one jerk, and bring him like a culprit to our sides: a slight reward would put them in ecstasies, and they would again scamper off for renewed captures. The most common species obtained was an *Agama*, the *Tapaya Douglasii*, and a very beautiful long tailed little lizard of a light pavonine iridescent hue. It measured about six inches or more, was particularly agile and appeared to great advantage, as it flitted rapidly before the sun from knoll to knoll. It was probably a *Cnemidophorus*. The habitations of all creatures of this class can be quickly found in the sand of that arid region, collected often in heaps around the interlacing roots of *Purshia tridentata* and a few *Artemisias*, and stinted grasses growing there.

On the 23rd July Mr. Douglas left Wallawalla and I felt his absence as a sad blank, only to be recompensed by a future meeting, a hope which however was never to be realized in this life. His thoughts were turned towards California, and he availed himself of the occasion of a return boat to Fort Vancouver to return to the coast. It was this year, in the beginning of August, that fever and ague first shewed itself on the Lower Columbia. Its ravages among the natives were fearful. Ignorant of the complaint, and accustomed to daily bathing, when the hot stage arrived, they would plunge themselves into the cold waters of the river and drag themselves out again merely to breathe their last upon the sand. The beeches in front of the crowded villages were strewed with dead. The aged and the young and mothers with their babes remained in the huts to perish; only the more robust flying to the mountains arrested the progress of the malady, and prevented it from entirely extirpating the river tribes; small pox could not have made a more destructive sweep. It remains a question for physicians to solve, how this intermittent, until then quiescent in

that quarter, should have at once broken out with such violence without any apparent reason. The banks of the river were unchanged, with the exception of about 100 acres of land, which had been only gradually brought into cultivation at the farm of Fort Vancouver. What possible effect could this cultivation have had on points thirty and fifty miles distant, where the complaint was equally prevalent? The disease has taken permanent root in that district of country. All at the establishment were sufferers by the unwelcome visitation, and Douglas was ill like others, but being something of a leech, had an early recovery, and recruited perfectly by following up his wonted healthful perambulations. He this season had added nearly one hundred new species of plants to his former discoveries.

I have a letter from him dated Fort Vancouver, August 4th, part of which I shall transcribe, as it partakes much of his lively style.

" Ere sundown on the day I left you, we encamped on the small gravelly island three-fourths of a mile below Day's River. The latitude of that stream, that is its junction with the Columbia, from two meridional observations of stars, and one observation of the polar star near the meridian, gave me 45°, 43′, 12″ N.

" Tuesday evening took us to the Cascades, the land of my little vain Indian Chumtalia. It was *Hyass* * Sunday with him. The whole earth from the east and from the west, from the most distant parts, had congregated to make mirth with him, and to *Patchatch* † on the never-to-be-forgotten occasion of the perforating the septum of his young daughter's nose, and piercing her ears. It would have been very ungallant to the young lady, as well as ungracious towards the father, to have pressed him or any of his band, to go with me to the mountain at such a time. I therefore deprived myself of that pleasure and proceeded to Fort Vancouver, where I arrived on Wednesday at kail time. Chumtalia in six days more, comes for me in his large canoe. You may look upon 121° 07′ 07″ W., as a very close approximation to truth, for the longitude of the upper throat of the dalles. Latitude 45° 37′, 47″, as ascending with you, verified to my entire satisfaction on my return. The centre of the portage of the Cascades, latitude 45°, 39′, 30″, the mean of several observations. Longitude 121°, 58′, 00″.

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* Hyass, great. † Patchatch, supposed to mean feast.

" I have arranged my barometer every way to please me, but I wish you had been with me to have lent me a hand, for I had some trouble boiling the mercury in the tube. Fortunately I can find only ·004 of an inch of index error, from the comparison I made with it and my others at Greenwich. I could have done no more, had I been in Dolland's shop. I shall give you the altitude of the mountains in my next, which I hope will be numerous, on the Willamette Ridge."

In fulfillment of this promise he wrote me again on the 29th November from Fort George (Astoria).

" By Mr. Ogden I was favored with your kind letter, relating to the crop on the Wallawalla River, together with other good things it contained. I hold myself greatly in your debt, and sincerely thank you for the same. I had an extensive journey in the Willamette with Mr. McLeod, and benefited myself, besides being greatly gratified by it. The valley is by no means of that extent generally ascribed to it; where we apply the test of measurement it indeed falls far short. The basin of the Multnamah, that is the country bounded on the east by the woody ridge of mountains that skirt the coast and generally keep parallel to it, and that ridge of the cascades which forms the platform of Mount Hood, (and of the culminant points of land to the south, which preserve a nearly south-west direction until they dip into the sea,) the termination of which is Cape Orford, is from the Columbia Valley to the most remote high lands that divide it from the Umptqua, only 127 miles, the breadth being about 70 from east to west, forming nearly a triangle. The soil is not so well calculative for tillage as represented. It is parched in summer, and its herbage destroyed by crickets. In winter it is deluged by rain, all its depressed parts, called plains, being covered with water. The highest land on which I was on that Willamette Ridge is 1043 feet elevated above the apparent base. This is barometrical but observe I should not adopt it, *only as a very close approximation* to its real height, for want of simultaneous observation at the base, when at the peak myself. I was obliged to take the mean of a series of observations before starting, and after my return, as true for the lower station. With all these disadvantages, I am truly gratified to state to you that my geometrical measurement was 1013 feet. All and more than ordinary care was taken as to the base line; and to do away with errors of eccentricity of the instrument and the like, generally found in the most perfect

sextants, I employed a reflecting circle. As I used it, all errors of the kind were insensible. By the same operation, I find 11,320 feet for Mount Jefferson. The day however was not so good as I could have wished, the snow capped summit was obscurely defined by reason of flaky and stray milky, clouds, that adhered to it with great obstinacy. This does not affect greatly the general result. I would have had much reason to rejoice, had I not had a misfortune on my return. On one of the rapid tributaries of the Mattnomah, I lost all my zoological collections, a dreadful loss, as it contained good things. It is curious; on the 17th November 1826, *I lost everything I had at the same place*, when returning from my southern journey! A *kelpie*, or elf is the charm of that stream,* so unfortunate to me. Since that time I have made my intended trip to the cascades with my friend Chumtalia. I accomplished all I wished. Poor Chumtalia is since dead. He was blown up by his powder horn which was on his person, and falling on his side, his knife entered about the fifth rib so that he died. He is now laid with his fathers. Your friends will have told you of the ravages a fatal intermittent fever has made among the red men in the lower parts of the river. I was ten days in that state, between hope and fear, but never was laid down. I am now thus far on my way to California. It will depend entirely on the country, and the facilities I meet with from the men in power there, whether my stay will be long or short; I shall feel gratified by being remembered by you, thought of and written to, if you can make it convenient."

He reached Montery at the winter solstice, the season when vegetation there again recovers from the autumn drought. The roots that have been parched by the summer's heat, again have imbibed humidity and send up their juices, and seeds that have been preserved sound by the dryness of the atmosphere, now swell under the rains, and shoot up with a rapidity unknown in northern climates. The beautiful *Ribes speciosum* there adorns the bush, and the *Nemophila insignis* with its delicate blue carpets the sandy lawn. Douglas now botanized among the ranges along the coast to the southward as far as Ste. Barbara, and then returning leisurely reached San Francisco in June. Thence he continued his route as far north as latitude 38° 45′, hoping to reach the spot where in October 1826, he had visited the great pine trees

* River Sandiam.

beyond the Umptqua, but in this he was disappointed. To have made the attempt with any degree of safety would have required the company of a greater party than he had the means of commanding. Thus he was constrained unwillingly to return.

So little intercourse was there in those days with San Francisco that he was detained all winter and spring there without finding an opportunity of shipping himself off, but his time was comfortably spent at the præsidias, where the hospitality of the *padres* was extended to him in so kind a manner that he ever warmly remembered it. The collections he made during all this long period were worthy of his high reputation. Above 400 species of the mass of plants which he sent to England were yet undescribed. Of these some were superbly flowering kinds, forming new genera, giving to botanists an enlarged idea of the productive vegetating powers of the soil and climate of Upper California. In August of 1832 a passage was at last obtained to the Sandwich Islands, where he was attacked by rheumatic fever, the consequence of too much exposure to the vicissitudes of the weather. Upon recovery he left for the Columbia, which he entered towards the end of October.

In March of 1833, he made a short tour by the Cowlidsk river to Puget Sound, where he took a rapid survey of the bays and headlands, determining their latitude and longitude, and obtaining the altitudes, bearings and distances of the snowy peaks that rear themselves up from the pine clad mountains, which swell out in increasingly formidable proportions as they retire from the sea. A number of mosses and algæ were collected in this quarter, classes which hitherto he had had but small opportunity of noticing. Immediately on his return from the Sound he favoured me with a letter of some length, which it may not be uninteresting here to insert, as it gives a description of California in some points as it then stood:

"Fort Vancouver, March 17th, 1833.

"Last August at the Sandwich Islands I had the pleasure to receive a letter from you, and in October on my arrival here a second, accompanied by a beautiful sample of cyanite, and fine specimens of my *Pæonia* from the Blue Mountains of Wallawalla. I am exceedingly obliged by this, and request to lay before you my best thanks for this mark of your goodness. Such allow me to say was bestowed where it is felt, and will be remembered. An hour

or two's conversation with you to renew the pleasant moments we passed in 1830, would at this time and distance of place, afford me the utmost gratification, the more especially to one so ill qualified for writing as I am. Indeed writing is out of my line of life. I spent 19 months in California and amassed a collection, of such an extent, as can only be equalled by its novelty and beauty. California is a most beautiful and highly diversified country. Snowy mountains, low hills clothed with wood, extensive plains, undulating grounds, in fact all except the Great River, which certainly sometimes makes but a cold feature in American scenery. The climate, though warm is healthy, and were it not for the intense drought of July and August, the soil would be very productive. In no part of the world have I experienced such a dryness in the atmosphere, nor can I call to my memory having read of greater. Even the deserts of Arabia and Egypt, the plains of Sin and Ispahan in Persia, I mean the driest places on the globe, when satisfactory observations have been made, are more humid than California. Often when the thermometer Fahr., stands at 80° or 100°, 30° or 40° of dryness is by no means unfrequent. On some occasions I have sunk the thermometer below *zero*, and after repeated trials, with all the care I am capable of bestowing on such a delicate operation, not the least particle of moisture could be detected. But nature ever kind and varied in her operations, compensates for this extreme dryness of the daytime by copious dews during the night, at all times proportionate to the dryness of the preceding day. Otherwise animals or vegetables could not live; the most would only be existence, and that for but a short period. In 1831, the rain was only ·700 of an inch, the 39th part of the mean of the English climate. Notwithstanding these great drawbacks to this beautiful country, it is the land of the vine, the olive, the fig, the banana, and in the southern parts, of the sugar cane, and a variety of the usual fruits seen in semi-tropical climates. The vine is cultivated to a large extent, from 10,000 to 100,000 in one vineyard. The wine is excellent, indeed, that word is too small for it; it is very excellent. I lived almost exclusively with the fathers who without an exception, afforded me the most essential assistance, hospitality to excess, with a thousand little courtesies which we feel and cannot express. I had no bickerings about superstition, no attempts at conversion or the like, the usual complaints of travellers, indeed so much to the contrary, that on no

occasion was an uncharitable word directed to me. When there I was under no restraint; my time was entirely my own, feast day and fast all the same, the good men of God gave me always a good bed, and plenty to eat and drink of the best of the land. A more upright and highly honorable class of men I never knew. They are well educated; I had no difficulty from the beginning with them, for saving one or two exceptions, they all talk Latin fluently, and though there be a great difference in the pronunciation between one from Auld Reekie, and Madrid, yet it gave us but little trouble. They know and love the sciences too well to think it curious to see one go so far in quest of grass."

"The Mexican territorial government as applied to California is abominable, and that is the mildest word I can use. The secular part of the community is sot so, some good and many bad. The ladies are handsome, of a dark olive brunette, with good teeth, and the dark fine eyes, which bespeaks the descendant of Castille, Catalan or Leon. They (sweet creatures) have a greater recommendation than personal attractions. They are very amiable. On this head I must say, *Finis*, otherwise you will be apt to think, if ever I had a kind feeling for man's better half, I left it in (Calida Fornax,) California."

"What a fine country for geology, finer than for botany. Perhaps I may at a future time discuss this matter, as well as give a treatise on the geographical distribution of plants indigenous to North America generally. This will occupy a considerable time, if ever I complete it; at all events much material in many departments is now in my possession as a ground work. But, great as is certainly this field for the naturalist, the Sandwich Islands, are, from their position on the earth's surface, their origin, and their great altitudes, still more interesting; and this interest is not diminished, from their having been the theatre of the tragic death of the illustrious Cook, and by the now well known good disposition of the natives.

"You may be aware that on Owyhee, on the lateral banks of Mouna Roa, or the Big, there is the largest volcano in the world, the mouth of which is nine miles in diameter, at this moment throwing out rivers of liquid fire. I cannot attempt to describe the sensations felt, the even fearful excitement experienced during my visit to this place. We have the trees of the world, the orange, lemon, coffee, banana, and tropical *tree ferns*, which characterize the features of warm countries, about the level of the

sea, farther up, those of more temperate climes, until we arrive at similar verdure to that found on the Scottish Alps, and lastly we reach the region of snow and ice, where nature forever denies to the wearied visitant the refreshing relief to the fatigued eye, of a blade of grass or even a moss. But to behold even verdure clinging to the craggy land perpetually bathed in vapours, composed of hydrosulphurous gas and other combinations, which to all other kind of vegetables would be utter, nay almost instant annihilation is a fact that claims attention. Thus, we behold apparent discordance in the great operations of nature, which manifest an infinite intelligence and power in the Almighty hand; in each being the life of the Eternal; in each climate, His unity; in every distant planet His ubiquity; in every provision the fulness of His mercy; and in the constancy of their action, His truth. The geological world knows nothing yet of the origin of volcanic forces, but we do know that they are the irregular secondary results of great masses of matter, obeying the primary laws of atomic action, that they differ in their intensity, are interrupted in their periods, and are aggravated, or restrained by an endless number of causes, external and purely mechanical. Of all modes of material combinations, this is perhaps the most complicated. To assume then that volcanic forces have not only been called into action at all times in the natural history of the earth, but also, that in each period they have acted with equal intensity, seems to be merely a gratuitous hypothesis, not formed on any of the great analogies of nature, and I believe unsupported by the direct evidence of fact. This theory confounds the immutable and primary laws of matter with the mutable results arising from their irregular combination. It assumes that in the laboratory of nature no elements have ever been brought together, which we ourselves have not seen combined; that no forces have been developed by their combinations, of which we have not witnessed the effects. And what is this but to limit the riches of nature by the poverty of our own knowledge, and to surrender ourselves to a mischievous but common scepticism, which forces us to deny the reality of what we have not seen, and even to doubt the truth of what we do not perfectly comprehend? In no place on the globe can the geologist better devote his time to reconcile and render harmonious this obscure but beautiful part of this exalted science, than at these islands. All that my feeble capacity can do is but a bubble.

"To console myself for the want of friends of a kindred feeling in this distant land, for an exchange of sympathy or advice, I vary my amusements; by day it is a barren place that does not afford me a blade of grass; a bird, or a rock, before unnoticed, from which I derive inexpressible delight, while during the stillness of a cloudless night their localities are determined, altitudes measured, the climate they breathe analyzed. Thank God my heart feels gladness in these operations; without such to pass away an hour, my time would be blank. I willingly admit however, there is one way, and one only way in which a man's powers may be cramped by the pursuit of natural truth, and that is by too ardent devotion to it. In the pursuit of any subject, however lofty, a man may become narrow minded, and in a condition little better than moral servitude, but by embracing different subjects, we need not fear on this head. Every department of science offers its spoils for our decoration. We can be carried into regions where we contemplate the most glorious workmanship of nature, and where the dullest imagination becomes excited. We can travel through distant lands and become acquainted with the complexions and the feelings and the characters of mankind, under every form of life; and in doing this, if we be not most indocile pupils we must learn many lessons of kindness, and freedom of thought along with appropriate knowledge of our immediate vocation."

"I shall have left the Columbia before you receive this hasty note, which I regret the more, as I shall not have the pleasure of hearing from you; however though far apart you are with me in recollection. Whether I return through the Russian Empire, or the islands of the south seas, I have not yet determined. My arrival in England is uncertain. May you enjoy all and every happiness this world affords, and may God direct your steps."

The Frazer's River County had not yet been seen by the indefatigable traveller. He therefore took a passage in the boats that were leaving Fort Vancouver on the 20th March, with the party preceeding across the Rocky Mountains, and quitted them at Okanagan in about latitude 48° 5′ 0″, striking north on horseback as far as Kamloops Fort on Thompson's River. Thence by adopting the same means of conveyance and keeping a northerly course he reached Alexandria on Frazer's River, in latitude nearly 52° 25′ 0, longitude 122° 30′. Embarking now on this river he continued up stream, taking the western Fork as far as Stuart's Lake

say latitude 54° 30′ N., longitude 124° 10′ W. Upon his return from this lake, he met with another of those unfortunate accidents, that cannot always be avoided in small canoes, and which had already so often occurred to him on the waters of the Columbia and its tributaries. He was wrecked in a dangerous part of the river, and again lost all the fruits of the toil of the present journey and the plants he had collected on the way. His relation of this disaster, which occurred on the 13th June 1833, is conveyed in a letter to his friend Sir W. J. Hooker."

"On that morning at the stony islands of Fraser's River, my canoe was dashed to atoms, when I lost every article in my possession, saving an astronomical journal, book of rough notes, charts, and barometrical observations, with my instruments. My botanical notes are gone, and what give me most concern, my journal of occurrences also, as this is what can never be replaced, even by myself. All the articles needful for pursuing my journey were destroyed, so that my voyage for this season was frustrated. I cannot detail to you the labor and anxiety this occasioned me both in body and mind, to say nothing of the hardships and sufferings I endured. Still I reflect with pleasure that no lives were sacrificed. I passed over the cataract and gained the shore in a whirlpool below, not however by swimming, for I was rendered helpless and the waves washed me on the rocks. The collection of plants consisted of about four hundred species, two hundred and fifty of these were mosses, and a few of them new. This disastrous occurrence has much broken my health and spirits. The country over which I passed was all mountainous, but most so towards the western ocean. Still it will ere long be inhabited."

To this last remark of the gifted Douglas we may safely attach the epithet prophetic. No one but a person of the highest intelligence and foresight would at that time have made it. The country was accessible only by the circuitous routes followed by the fur traders through hilly mountainous districts, and was roamed over solely by wild Indian tribes. Now it is traversed in every direction by those of the white race who search for gold, and who will establish themselves, whereever the yellow dust may be found, or whereever the soil and climate may render the cultivation of the earth, or a pastoral life, agreeable."

ART. XXXIX.—*On the Track of an Animal lately found in the Potsdam Formation.* By Sir W. E. LOGAN, F.R.S.

(*Read before the Natural History Society of Montreal, June,* 1860.)

The Potsdam sandstone is recognised in Canada and New York as the base of the Lower Silurian series. As far as we are certain of the formation in the province it rests unconformably upon the Laurentian series ; but on the north shore of Lake Huron, the Huronian series supports unconformably a sandstone which has been supposed to be Potsdam ; as no fossils, however, have been met with in it there, its equivalence is somewhat doubtful, particularly as the superior fossiliferous rock into which it passes, appears to be of the Bird's-eye and Black River group.

Mr. Barrande in a paper communicated to the Geological Society of France about a year ago, compares the Potsdam formation with the Primordial Zone, and appears disposed to unite it with the strata marked by *Paradoxides* near Boston in Massachusets, and Placentia Bay in Newfoundland, the first locality yielding *Paradoxides Harlani* which he identifies with his *P. spinosus*, and the latter Mr. Salter's *P. Bennetii*, and probably other allied genera and species. But while no well ascertained Primordial species have been met with in the Potsdam of Canada and New York, the formation appears in Canada to be rather allied to the strata above than those below it.*

In the Potsdam of Canada and New York, independent of fucoids, the number of species of which the forms have been either wholly or partially preserved is only three. Two of them are *Lingulæ*, named by Hall *L. prima*, and *L. antiqua ;* and while these so far resemble one another that they might by some palæontologists be considered varieties of one species, we in Canada have a *Lingula* (*L. Belli* of Billings,) in the Chazy, which might almost be considered another variety of the same species, the peculiarity of them all being the length and sharpness of the beak. In Canada there is also found in the Potsdam, the impression of the spire of a large flat *Pleurotomaria*, which so strongly resembles the spire of *P. Laurentiana* (Billings) of the Calciferous, that they can scarcely

* Since this paper was read, it has been ascertained by Mr. Billings, that the trilobites found in the Potsdam at Keesville, New York, and presented by Mr. Dana at the meeting of the American Association at Montreal in 1857, belong to *Conocephalus*, one of the genera characterizing the Primordial Zone in Bohemia.

be distinguished. In addition to these upward affinities in the only preserved forms, there are beds of passage between the Potsdam and Calciferous formations, in which the strongly marked distinctive lithological characters of the two are well preserved, and at St. Timothy on the Beauharnois Canal those beds of the inter-stratification which are allied to the lower rock are occasionally marked by *Scolithus linearis* (Hall), supposed to be ancient worm-holes, by which the Potsdam is characterised in many parts.

Immediately beneath these beds of passage are the celebrated foot prints of Beauharnois, to which Professor Owen has given the name of *Protichnites.* Since these were described by Owen, nothing has been discovered to throw farther light upon the forms of the animals which made these impressions ; but in thinning a large specimen with some of the tracks on it, for the purpose of placing it in the museum of the Geological Survey, it was ascertained that the surface on which the traces were impressed must have been subject to the ebb and flow of a tide. The surface on which the tracks are impressed and the one immediately beneath, shew ripple-mark; the next in succession which is about an eighth of an inch below, shews wind-mark, in a number of sharp and straight parallel ridges from two to four inches long and an eighth or a quarter of an inch wide. These characterize a considerable surface, and are precisely similar to the marks so familiar to every person who has examined blown sand. The surface must thus have been alternately wet and dry, and the organic remains of the formation being marine, we have thus pretty clear evidence of a tide.

Proverbially unstable as water is, the mean level of the sea, that is the point which is half-way between high and low water, is supposed to be the least changeable level on the face of the globe, and taking it to be now pretty much as it was during the Lower Silurian period, we establish the means of knowing approximately how much the position where the tracks are found, is higher than it was when these were impressed, the limit of error being the number of feet which would represent the difference between the ebb and flow of the sea in the locality, or perhaps not more than fifty feet. We have thus a bench-mark to test the rise not only of these strata at Beauharnois, but of their equivalents, wherever else they may be met with.

Finding that this ancient sand bank was exposed at the ebb of tide we naturally look out for some coast to which it was related.

The Potsdam sandstone terminates some twenty miles to the north at a very low angle against the foot of the Laurentide hills, which rapidly rise up 500 or 600 feet above the Silurian plain. There is little doubt that we have in the flank of those hills the ancient limit of the Lower Silurian sea, the shore of which is thus traceable from Labrador by the north-west, to the Arctic Ocean, a distance of 3,000 miles. But though we have thus evidence of a Lower Silurian dry land and can scarcely suppose that it was wholly destitute of vegetation, we have not yet discovered any certain drifted vestige of its plants along many hundred miles of its coast.

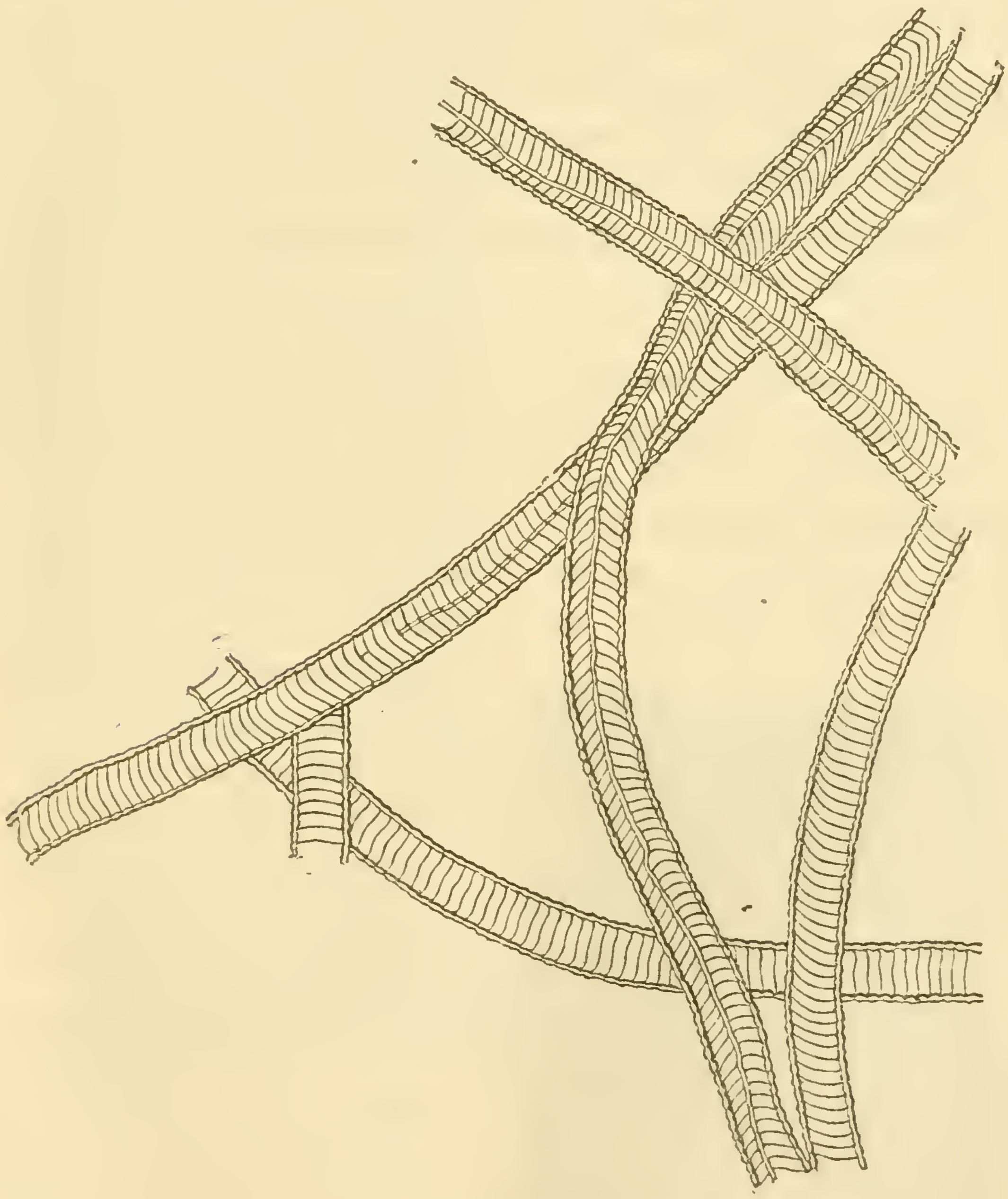

Fig. 1, One-thirtieth nat. size.

The crustacean which impressed the tracks at Beauharnois must have been a litoral animal, tracks of which have now been found in several places nearer than Beauharnois to the marginal limit of

the sea to which it belonged. These localities are St. Ann, Vaudreuil, Presqu'ile, Lachute, and St. Elizabeth, and they were last year observed in the neighbourhood of Perth. In the last locality they are associated with a new and remarkable description of track for the discovery of which we are indebted to my friend Dr. James Wilson of Perth, who sent me specimens of it in the month of November last.

The largest of the specimens was between two and three feet long by a foot wide, and the track upon it so singular that I became desirous of obtaining a greater extent of the trail. For this purpose, in the beginning of Deccember, I sent Mr. Richardson to Perth, where he was guided to the quarry by Dr. Wilson, and shewn the bed in which the tracks occur. The quarry, of which the strata are nearly horizontal, is about a mile from the town, and with the aid of Mr. Glyn, the proprietor, Mr. Richardson obtained in fragments, a surface which measures about seventy-six square feet. To obtain this required a good deal of patienee, for there was half a foot of snow on the ground, and from under this it was necessary to remove between two and three feet of rock in order to reach the bed The rock is a fine grained white sandstone similar to that in which the *Protichnites* occurs at Beauharnois, and of that pure silicious character which is so well known to belong to the Potsdam formation wherever it is met with. The tracks are impressed on a bed which varies in thickness in different parts from one eighth of an inch to three inches. When the upper bed was removed large portions of the track-bearing bed came away with it, and it was necessaryto separate the layers. This was done by heating the surface with burning wood placed upon it, and then suddenly cooling it by the application of snow. This of course cracked and destroyed the thin bed with the impressed tracks, but it left the mould of them on the underside of the upper bed, and by plaster casts from this we have obtained the true form of the original racks.

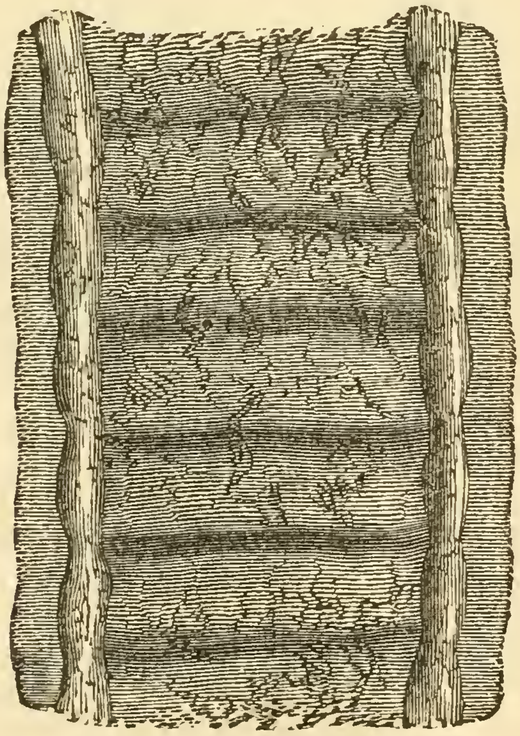
Fig. 2, One-fifth nat. size.

These tracks consist of a number of parallel ridges and furrows something like ripple marks, which are arranged between two narrow continuous parallel ridges, giving to the whole impression a form very like that of a ladder, and as the whole form is usually gently sinuous it looks like a ladder of rope. The surface obtained shews six different trails, (Fig. 1,) the longest of which is about thirteen feet, but they are all of the same breadth, and they may all have been impressed by one and the same animal. The breadth of the trails is about six inches and three-quarters to the outer sides of them.

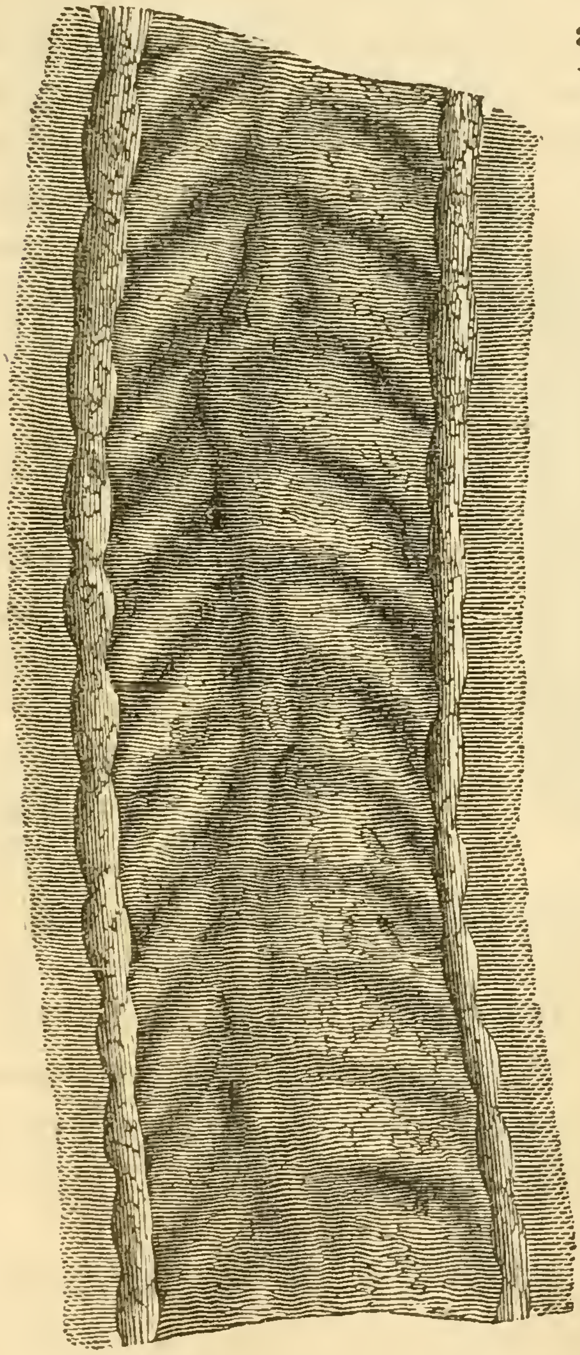

Fig. 3, One-fifth nat. size.

The transverse ridges and furrows are sometimes straight (Fig. 2,) and sometimes curved (Figs. 3-4-5.) When straight and regular they measure about an inch and three-quarters from the middle of one furrow to that of the next. The height of the ridge is usually from one and a half to two lines, and from the highest part the distance to the middle of the furrows is about an inch and a quarter on one side and half an inch on the other, thus giving to the ridge a sharper slope on the shorter side. The tops of the ridges, and the bottoms of the furrows are somewhat rounded.

Though the transverse ridges are occasionally straight (Fig. 2) they are in general either slightly or considerably curved (Figs. 3-4-5), and when so, the chord of the curve is seldom quite at right angles to the direction of the parallel side ridges, one end of the chord in the greatest obliquity observed being as much as two inches and a half in advance of the other (Fig. 3). The height of the curve

above the chord is sometimes as much as an inch and three quarters. It is often somewhat pointed, and the highest part is not always in the middle between the parallel side ridges (Fig. 4). The concave side of the curve is always on the steeper side of the tranverse ridges.

There runs along the track a ridge intermediate between the two parallel side ridges, (Figs. 3-4-5), and though it is not so conspicuous as these, it is seldom altogether wanting, but appears to be, most obscure when the transverse ridges, or rounds of the ladder, are straight. This intermediate ridge does not keep parallel with the side ridges, but occasionally runs in sinuous sweeps from within an inch and a half of one side (Fig. 5) to the same distance from the other; sometimes however, it runs nearly parallel with the sides for a considerable distance, either in the middle or somewhat on either side of it. In one of the tracks there is in the course of the intermediate ridge a sudden dislocation of an inch and a quarter (Fig. 3 towards the top,) on the opposite sides of one of the transverse ridges. The course of the intermediate ridge appears in general to coincide with the successive most salient parts of the transverse ridges when these are curved, but this is not always the case (Fig. 4). The intermediate ridge appears most conspicuous where it crosses the transverse furrows, yet its crest or line of summit seems to undulate with the ridges and furrows, though not to so great a degree.

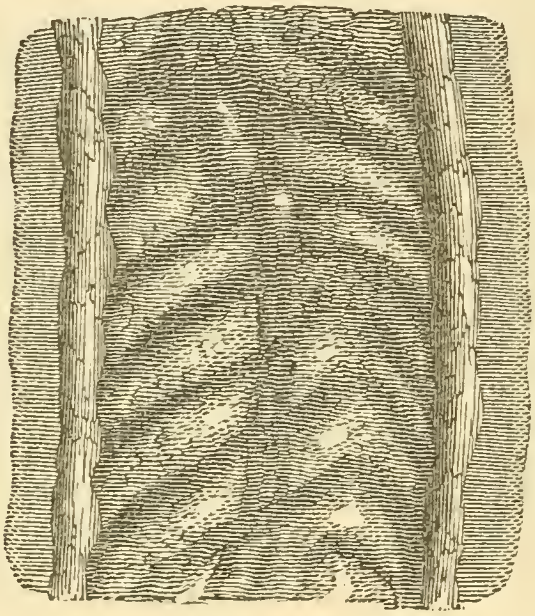

Fig. 4, One-fifth nat. size.

The inner flanks of the side ridges appear to be continuously even surfaces, making an angle of 155° with the plane of the intermediate spaces, and against these sloping flanks the surface of the transverse undulations forms a decided, though very obtuse set of angles, just like waves rolling along an inclined plane in the direction of its strike. The side ridges are rounded at the top, and while their exterior flanks are more precipitous than the interior

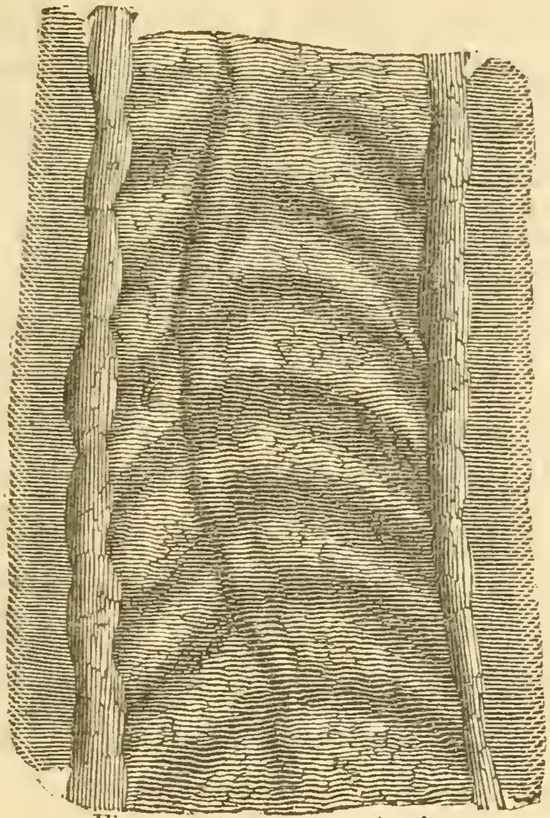

Fig. 5, One-fifth nat. size.

ones, they swell out opposite to each transverse furrow, thus giving to the side ridges a beaded or knotted aspect, each bead of the series standing opposite a furrow. The highest part of these lumps is about three lines above the bottom of the furrows, and about a line and a half above the surface on which the track is impressed.

My naturalist friends to whom I have exhibited the specimens, appear disposed to consider the tracks those of some species of gigantic mollusc, and I am given to understand there is now living some small mollusc, whose track presents a series of transverse ridges and furrows, without, however, the longitudinal ones. From the resemblance of the track to a ladder, the name proposed for it is *Climactichnites Wilsoni,* the specific designation being given in compliment to its discoverer, Dr. Wilson.

ARTICLE XL.—*Notes on the Coal Field of Pictou.* By H. Poole, Esq., Superintendent of the Fraser Mine.

(*Communicated to the Natural History Society by Principal Dawson.*)

[The facts contained in the following communication, may be regarded as supplementary to those noticed in my Acadian Geology, and in a paper by Mr. Poole and myself, published in the proceedings of the Geological Society. The coal measures of the Albion mines, dipping to the N. E., at an angle of about 18°, contain the great main seam, 36 feet in thickness, and 157 feet below this the deep seam, a bed of inferior but still great thickness. To the north-west these coal measures are apparently cut off by a great bed of conglomerate dipping north, beyond which occur other coal measures, also with northerly dip. For rea-

sons stated in the publications above mentioned, I regard the great conglomerate of New Glasgow above referred to, not as a recurrence of the Lower Carboniferous conglomerate, but as a bed of the date of the coal formation, a contemporaneous shingle beach, which shut off the Albion Mines coal area, and occasioned its exceptional character. In connection with these facts and views, Mr. Poole's observations bear on the following points; (1). The character of the coal measures below the deep seam, previously little known. (2). The sudden bending of the outcrops of the coal seams to the southward, west of the Albion Mines, so that they assume northerly dips for some distance, though they appear to return to a N. E. dip further to the westward. (3). The occurrence of a narrow and abrupt synclinal immediately to the N. E. of the Albion Mines, succeeded by an anticlinal, near the axis of which in this locality is the outcrop of the great conglomerate. (4.) The results of explorations made in the measures north of the conglomerate, confirming apparently the difference of these in character, from the great coal measures south of the conglomerate. (5.) The frequent occurrence, as at the Joggins, of scales of fishes, bivalve shells, *Cypris* and *Spirorbis* in connection with the beds of "Oil Shale," and coal. I have added a notice of these fossils to Mr. Poole's paper. J. W. D.]

The operations of the Fraser Oil Coal Company were carried on during the past year in a seam of coal and bituminous shale situated upon the Coal Brook, and underlying the seams of bituminous coal worked by the General Mining Association.

The respective out crops of the deep seam and the Fraser oil coal being 528 yards apart on the surface, and the general dip N. 42° E., at an angle of 18 degrees, or 1 to 3, the oil coal will underlie the deep seam 528 feet in perpendicular section.

It is situated about 60 feet below the tabulated section given in Haliburton's History of Nova Scotia, which distance is chiefly occupied by strong bands of sandstone, whose actual thickness is not yet proved, thin soft shales with bands of ironstone, *Stigmaria* with *Sigillaria* and a few detached fern leaves (*Neuropteris*), in such soft shale that I have not been able to preserve any good specimens. Immediately above the oil coal are fourteen inches of bituminous coal, but only the lower four inches are of good quality, the upper part being of a soft friable nature, producing a great deal of ash.

The oil coal has a smooth regular parting at top, next to the

coal, as well as at the bottom, next to the oil shale, but varies in its thickness from a few inches up to twenty. Throughout its entire thickness it has a curled and twisted structure, many of its fractures look like the casts of shells, and the sharp edges are polished and stickensided. No fossils that I am aware of, have hitherto been found in the "curly" oil coal, but scales of calcareous spar are often met with in the joints. The oil shale next below is nearly two feet thick, of a homogeneous character with a shaly cleavage of various thicknesses. In this band a few scattered ganoid scales have been found, and two or three varieties of lepidodendron beautifully preserved, also leaves of *Cordaites* of various lengths and breadths, which have undergone so little change, that pieces from four to six inches long, and in breadth about a quarter of an inch, could be removed when the shales were first split, and were so elastic that they could be bent considerably without breaking. In the argillaceous shales below are bands containing innumerable *Cypris* and *Spirorbis* shells. The crop of a small seam of coal which must underlie the oil coal about thirty feet is seen in the brook. There are surface indications of the coal measures continuing for a considerable distance towards the south-west, and this has been proved to be the case by Robert Culton, who is opening up a seam of coal upon his farm upwards of one mile and a quarter distant, to the rise of our mine, which will be alluded to hereafter.

There are numerous small faults running across the measures in the Fraser Mine, which are uniformly downthrows to the west: and I may here mention that I observed some years ago in the deep seam several faults of from four to ten feet each, which could not be found in the main coal workings above (the distance between the two seams is 157½ feet), which shows that the disturbances must have taken place previous to the formation of the main coal seam; a fact which should not be lost sight of in investigating this extensive coal-field.

The oil coal has been traced from the Fraser Mine eastward as far as the main road, but from thence down to the East river there is a great thickness of drift which appears to have cut off the crop. It has not been traced on the east side of the East river, and, although a bed of oil coal has been found and worked by A. Patrick on the McLellan Brook, I am inclined to think it is not a continuation of the same seam, but—from the fossil—sof one much lower down in the coal formation.

To the west the oil coal has been traced for half a mile, with a line of strike parallel to the deep and main seams, or a course about N. 50° W. to the top of the hill, where there is evidently some disturbance, the sandstone appearing on edge and dipping in different directions. It was next found in the McCulloch Brook at a considerable distance up the brook, or to the south of the general line of strike, where it was found to dip 13 degrees, N. 67° W. The oil coal is here of a much richer quality than at the Fraser mine, and from the free way in which it burns, throwing off stars or sparks of light, it has been named Stellar coal to distinguish it, and an adit is now being driven in it back towards the Fraser mine. It also varies in thickness from two to twenty inches, and as the coal roof is regular, I should infer from the twisted appearance of the oil coal that it has been in a pasty state and subjected to great and unequal pressure.

1600 tons of two qualities were shipped to Boston, in 1859, from the Fraser mine, the top seam of curled coal yielded in the D retorts 63 gallons per ton, and the second quality of shale, 45 gallons per ton of crude oil. A small sample of the stellar coal gave 77 gallons per ton of crude oil. I am told that the rotating retorts produce 30 per cent more oil from the same material than the D retorts. Some picked samples from Duncan McKay's adit tried in Boston gave 199 gallons per ton. Torbane Hill mineral yields 125 gallons; the Albertine coal of New Brunswick gives 100 gallons, and the Lesmahago Cannel of Scotland gives 40 gallons per ton of crude oil.

Professor How of Windsor has sent me the following analyses of these coals.*

Fraser Mine	No. 1.	Stellar Coal McCulloch Brook.	
Moisture	0.39	Moisture	0.23
Volatile Matter	33.43	Volatile Matter	66.33
Fixed Carbon	10.78	Fixed Carbon	25.23
Ash	55.40	Ash	8.21
	100.00		100.00

The ultimate analysis of the Stellar Coal yielded;—

Carbon	80.96
Hydrogen	10.15

Two small trial holes have been made by Mr. R. Culton in the bank of the McCulloch Brook at $124\frac{1}{2}$ chains distance from the

* Professor How has since published these and other analyses in a paper in the Ed. New Phil. Journal, and Silliman's Journal.

south division line of the Fraser mine. The coal measures dip N. 40° E. 22°, but as there is the appearance of a fault which has thrown up the measures, they will no doubt be found lying flatter when sunk upon to the deep.

There is here a confusion of seams, consisting of bright bituminous coal, and cannel-like curled oil coal with bituminous shales; in the latter is an abundance of fossils. I obtained *Lepidodendron*, *Cordaites*, and other markings which I have regarded as similar to the *Cardiocarpon acutum* of Mantell; also a stalk, with a head like ryegrass.* One band or more of the shales contains innumerable *Spirorbis* and *Cyprides*, and accompanying them are ganiod fish scales, teeth and spines. Thick plates or scales are also found on the same slab with the *Cardiocarpon.* Similar plates are found at J. McKay's mine south of New Glasgow, as well as in the bituminous shales near Smelt Brook, and at the basin; both of the latter places being to the north of the conglomerate ridge. There are appearances of crops of coal and shales in several places on the McCulloch Brook between Robert Culton's farm and the Fraser mine, but they have not yet been examined.

Proceeding down the McCulloch Brook to the adit worked in the stellar coal, and at about 200 yards distance south, underlying the stellar coal, is the crop of a coal seam about five feet thick, dipping 21° N. 25° W. of inferior quality, with a band of calc spar running through it (the same thing was observed in a trial pit sunk to the rise of the oil coal on Duncan McKay's farm) with *Sigillaria*, *Stigmaria* and *Cordaites* in the soft crumbing coal, so that specimens could not be preserved; a thin seam of coal with shales lies about 30 feet below the stellar coal dipping 16° N. 55°W.

The stellar coal seam has a black friable clay above the coal, with ironstone balls in the shale above. *Lepidodendron* and *Stigmaria* have been found in the coaly bands, and *Cordaites* in small fragments and one *Cardiocarpon?* (similar to those at R. Culton's seam), have been found in the clay ironstone; also a few ganoid scales and nodules full of soft ochreous matter, of no decided form. The measures here are much disturbed: in the adit on the east side of the McCulloch brook the dip is 13° N. 67° W.; while on the west side of the brook the stellar coal dips 12° N. 45° E.

* Antholithes?

We have not been able to trace the strike of the stellar coal farther west, owing to the covering of drift, which ranges from 40 to 50 feet in thickness between the two brooks. At 220 feet from the entrance to the adit we have cut a fault running north-west and south-east, which is a downthrow to the east, and is the first of that kind that has been met with in the Albion coal field. Its size has not yet been accurately determined, nor whether it is the main fault, or only a branch that has thrown all the coal measures round, and made their outcrops so much farther south than the general strike at the Albion Mines indicated *.

Descending the McCulloch Brook, but in ascending order for the measures, some trial pits and boreholes have been sunk, but only thick beds of fire-clay and black shales discovered; at 15 chains distance from the stellar coal is the crop of a coal seam, thickness not satisfactorily proved, with a band of shale full of *Cypris*, dipping N. 20° W. At the next bend of the brook three chains distant is the outcrop of beds of sandstone dip N. 22° E. 15°; and three chains further on is a coal seam five feet or more in thickness, with bands of shale intermixed dip N. 26° E. 7¼°; thence the distance is five chains to the old Middle River Telegraph road, where there is another crop of a coal seam, which I believe to be the continuation of the deep seam of the Albion Mines; dip 12° due north. Here also the measures are disturbed by small faults, and the pit is sunk on the crop, so that we cannot judge very correctly of the actual thickness, or quality of the seam. Nineteen feet 5 inches of coal have been sunk through, of which Mr. Fraser is working the lower 7 feet 3 inches; I have made the following analyses.

Deep Seam		Sp. Gr.	Vol. Mat	Coke	Fixed Carbon	Ash		Color of Ash.
No. 5 Band 1	2.9	1.355	22.50	77.50	67.00	10.50	Cokes	Grey white.
2		1.383	22.25	77.75	60.50	17.25	do	Dun.
3		1.342	21.50	78.50	70.25	8.25	do	Dun white.
No. 6 Band	2.0	1.440	20.00	80.00	57.00	23.00	do	Grey white.
No. 7 Band	2.6	1.335	20.00	80.00	68.00	12.00	do	Dun white.
Worked	7.3							

Lepidodendron got in No. 6. Band.

Eight chains further north is the crop of another coal seam which shows in the brook for a breadth of two chains, and therefore corresponds with the main seam. *Stigmaria* was got in the

* While I am writing we have struck another fault bearing N. 8° W., S. 8° E., dipping S. 82° W. 45°, being an upthrow to the east, and of which the first fault is a branch. It is eight feet up as far as we have gone, and we are not yet through it.

underclay at a small trial pit. The shales and sandstones dip south on the old Glebe and Duff's farm to the north of the Association's reservation; and at the Burial ground I found by the bank of the East river the measures dipping S.20° E.63°; showing ripple marked sandstone, *Calamites* and *Stigmaria*: the shales contained *Cypris*. At the Gondola wharf the shales dip S. 45° E. 50°; and by the side of the old quarry road (Fraser Ogg) we sank a pit 15 feet and got one foot of the curly oil coal, dip S. 20° W. 50, but it thinned out in going down and was close on the conglomerate.

At the Basin there are several thin seams of bituminous shale. An inch of coal shows about fifteen feet above the shale at the dam, containing fish remains, but it did not appear in the trial pit. The position and thickness of the bed containing the fish remains and *Cypris* corresponds with the upper seam of bituminous shales on the opposite side of the East river. They yield upwards of 60 gallons of crude oil of superior quality to the ton; but are too thin to be worked profitably.

We are now boring to prove the measures at Mathieson's farm opposite to the Loading ground, and have sunk a pit down 14 feet on drift gravel and clay, then 5 feet of soft blue sandy clay with no regular cleavage, full of fossils. I obtained *Lepidodendron*, *Lepidostrobus*, *Calamites*, *Pecopteris*, *Neuropteris*, and fragments of other plants, but the clay was soft and crumbled immediately on exposure to the atmosphere so that I could not preserve good specimens: then followed three inches of black friable clay; then 1.3 of good coal yielding water, dip 5° N. 25° E.; succeeded by strong grey sandstone, through which we are now boring. At Forbes's Point a borehole was put down 75 feet but nothing obtained but red and white sandstone in thick beds.

At low water an inch of coal and fire-clay is seen to crop out upon Skinner's point but nothing else has been observed along the shore of the Middle River.

Returning up the East river to Smelt Brook, several seams of bituminous shale and sandstone appear in the bank, also one small seam of an inch of coal, with sandstone bands of different thicknesses and qualities; the No. 1 and 3 seams of shale are particularly full of fish remains and coprolites near the roof, and the large plates appear like *Glyptolepis* figured in Miller's Testimony of the Rocks, page 229: I also found one or two grooved plates which correspond with the *Osteolepis*. The roof of No. 1

seam is one mass of *Cypris* shells; No. 2 contains principally small ganoid scales; No. 3 seam has small fish jaws and small *Lepidodendron and Poacites* on the roof.

The sandstone bands contain *Calamites*, and large roots of *Stigmaria* with their accompanying rootlets. Here the inch seam of coal appears below the bands of bituminous shale succeeded by the *Unio* shells, unless fault has caused the outcrop of these bands to be repeated.

Ascending the East river and to the south of Smelt Brook, is a thick band of coarse sandstone full of hard flattened red concretionary balls and ripple marked; then comes a four inch band, of honey-combed, concretionary limestone, in which I have detected a piece of shell in the fresh fracture, and which looks like the metamorphic rock near Churchville. I could not find any fossils in the pit sunk at Sinclair's cove.

The adits driven in upon the coal to the south of New Glasgow, by the side of the road to Antigonish, are upon the anticlinal axis; both mines have the same fish remains in the roof, and limestone pavement, and cannot be worked far to the northwest before they will be cut off by the conglomerate. The fish teeth are abundant in the roof. In one slab four by six inches, I counted fifteen large *Diplodus* teeth. Higher up the brook and road, I am told, the crop of the coal shows a dip to the N. W., but I have not yet seen it.

The shales and coal up the McLellan Brook, dip from E. by the bridge at George Fraser's farm, to S. 15° E. at Turnbull's farm, then the measures are reversed, and at A. Patrick's adit, they dip N. 45° E. 30°; where the oil shales have been worked for about 100 feet, and having struck a fault have been cut off by the other shales dipping S. 20° E. 25°. Mr. Patrick has proved a seam of bituminous coal about three feet thick, dipping to the N. E. underlying his oil shales near the foot of the mill dam, in addition to the small seam which shows in the bank of the mill pond. I am told that the high conical hill just verging to the south, contains iron ore, and that it is succeeded by limestone.

[Among the fossils sent by Mr. Poole, the most interesting are the following:

Of placoid fishes there are, 1. *Diplodus penetrans*, N. S. This is smaller than the species *D. acinaces*, found commonly in the upper part of the Albion Main Seam, and described by me in a supplementary chapter to my Acadian Geology, now in press.

The height of the tooth is $2\frac{1}{2}$ lines, and almost equal to the breadth. The lateral denticles half as broad as high, flattened and serrated, especially at the outer margin and near the base; cross section of the denticles rhomboid. They diverge at an angle of 35° to 40°. The central denticle is minute and conical. 2. *Ctenoptychius*, a small species indicated by a tooth with eight denticles. The specimen is an imperfect impression.

Of ganoid fishes there are numerous scales of small species belonging to *Palaeoniscus* or allied genera, broad flat scales punctured and lined after the manner of *Osteoplax* of McCoy, and others marked with fine wavy lines, as in *Holoptychius* or *Rhizodus*. There is also a curved conical tooth belonging to one of these latter fishes, and differing from others that I have seen in having the concave side marked with fine spiral ridges nearly to the point. There are also certain flat sabre-like spines of small size, but much resembling in form those of the Devonian *Machæracanthi.*

The above are chiefly in the coals and shales overlying or near the great conglomerate. In the lower measures at McLellan's Brook, are bivalve shells of that modiola or unio-like form, characteristic of the fresh and brackish water portion of the coal measures, and which I have elsewhere designated by the generic name *Naiadites*. They are all thin, inequilateral, toothless, and marked by concentric lines of growth. A new species in the present collection, *N. obtusa*, is characterized by the broad and truncate outline of the anterior extremity, giving it a somewhat quadrilateral form.

The *Spirorbis* found abundantly in several of the beds noticed, is the ordinary *Sp.* (*Microconchus*) *carbonarius* common to the American and European coal fields.]

ARTICLE XLI.—*On new Localities of Fossiliferous Silurian Rocks in Eastern Nova Scotia.* By Rev. D. Honeyman.

(*Read before the Natural History Society.*)

This subject has already been very fully discussed in Dr. Dawson's Acadian Geology and in his recent paper read to this Society, with Professor Hall's elaborate and valuable Memoir on the Fossils of Arisaig.

A few notes by another observer who is now labouring in the same interesting field may not be unnecessary and unacceptable. A catalogue of the most interesting Silurian Sections in Nova Scotia is already given in the paper referred to. To this I would now add two altogether new and equally interesting localities, which I shall endeavour to describe, adding some observations upon a supposed extension of the Arisaig Section.

The first of these localities is to the S. W. of Merigomish in the county of Pictou and on the north of the Metamorphic hills that extend between Barney's River and East River, *vide* Dawson's Geological map of Nova Scotia. The first and lowest part of the section, as yet observed, occurs at a place where the Antigonishe and New Glasgow new road crosses a small brook about 3½ miles west of Barney's River and to the east of French River and about 5 or 6 miles from the Gulf of St. Lawrence. Here there is a quantity of shale which is apparently very little altered, having fossils in good preservation. At the side of another small brook to the westward, we have similar shale with correspondeng fossils. This appears to be equivalent to the Arisaig group of Clinton age, as we have here the *Graptolithus Clintonensis*, *Strophomena corrugata* and a species of *Orthis* which is characteristic of the Graptolite shale of Arisaig; we also found a trilobite which is however different from any that has been met with at Arisaig. We have also fossils like those of the upper Silurian group of Arisaig, abounding in the drift from French River, till near Sutherland's River, where there is a small brook which is crossed by the road already referred to, and which has on the one side drift with Silurian fossils and on the other or northern side the lower carboniferous Conglomerate.

Among these fossils we find *Homalonotus Dawsoni*, *Dalmania Logani*, *Beyrichia pustulosa*, *Chonetes N. Scotica. Chonetes tenuistriata*, *Crania Acadiensis* and other organisms characteristic of the Arisaig series.

There is thus every reason to suppose that we have here discovered a section exactly parallel to that of Arisaig. On account of its inland position we cannot have the aid of old Neptune in disentombing its ancient inhabitants, so that its fauna cannot be collected and studied with equal advantage. It is nevertheless to be regarded as interesting on account of its similarity; and as collections of its organisms even under existing circumstances are by no means insignificant, either in number or variety, it is possi-

ble that a detailed examination of this new locality may aid in unravelling some of the Arisaig mysteries.

The second new section to which we would refer is situate at the head of Lochaber Lake in the county of Sidney, and on the east of the Ohio River. It appears to extend about 2 miles from N. to S. on the west side of the lake. The strata consist of grey slate which has been very much hardened and thrown into a vertical position. The fossiliferous strata appear only on one side of the lake, except where it bends in a westerly direction, and the highest of the Lochaber hills approaches the lake, and then a patch of the grey slate appears on the opposite side. A small lake to the west of the great lake, and from which a stream flows into the Ohio River, bounds a considerable part of the western side of the section. Where the strata are exposed on the highest or S. W. side and in the beds of two or three small brooks, fossils are found *in situ*. Their number is considerable but their variety does not yet appear to be great.

In consequence of the highly altered state of the strata, casts only are found, but these are often very beautiful. In this state we have abundance of *Pentamerus*, *Orthis*, *Cornulites* and corals. These all appear to be characteristic of this section. A conical or turbinated species of coral is peculiarly so and is of very frequent occurence and often very perfectly preserved.* It is truly beautiful, and appears to the common observer as the most striking of the Nova Scotia silurian fossils in my collection.

I have also found here, but not in situ, a cast of a large *Orthoceras*. Its length is 8 inches—it tapers very little—the siphuncle is central—cross section is elliptical having a transverse diameter of $1\frac{1}{2}$ inches and a conjugate diameter of 1 inch. The fossils of this section are generally found like our elegant coral and *Orthoceras* in the cairns piled up by the farmers in the overlying fields. In the cairns of the northern part of the section the fossils appear chiefly to correspond with those of the upper group of Arisaig. Here we have the *Dalmania Logani* the *Calymene Blumenbachii* the *Bellerophon trilobatus*, and a tuberculated criniod, so that it is possible we have here an equivalent of the upper Arisaig groups as well as a lower group probably the equivalent of the Wenlock limestone of Murchison.

I hope yet to have opportunities of examining these sections

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* A *Zaphrenitis*, see note.

more in detail, and of submitting full collections of their fossils to the proper authorities, in order that their true age and the character of their organisms may be determined.

I would refer also to a subsection, which although not so interesting to the collector may be of equal interest to the geologist, as it is possibly to be regarded as a descending continuation of the Airsaig section. It occurs at Doctor's Brook about 2½ miles east of Arisaig Pier. This will make the whole Arisaig section extend about 5 or 6 miles S.E. and N.W.

The Silurian strata are here very much altered and distorted, arising, as Dr. Dawson has already observed, from volcanic action of the carboniferous era. Of this there are obvious remains existing at various points along the sea shore from the conglomerate on the east to the conglomerate on the west of the Arisaig Silurian strata, or from Malignant Brook till beyond McCara's Brook, a distance of at least ten miles. In Malignant Brook and a little brook to the eastward, we find subcrystalline trap in immediate contact with the lower carboniferous conglomerate, and the latter has consequently become very much hardened; to the west of this the section is obscure and depressed till we reach a small brook having elevated ground on its western side, and there is no appearance of rock of any kind until we meet the subcrystalline trap and altered Silurian strata of Doctor's Brook. From this point to Arisaig Pier we find the same kind of trap in contact with the Silurian strata, and converting these into a red jaspidaceous rock or otherwise hardening and altering them in proportion to their proximity to the point of contact. The results are the conspicuous red and oblong rock locally known as the "Frenchman's Barn," the breakwater of Arisaig pier, the hardening and tilting of the slate and shale near the Frenchman's Barn and the prevailing disorder of the Arisaig Section.

When we again meet with volcanic rock, it assumes the form of beds of amygdaloid associated with the lower carboniferous conglomerate at McCara's Brook.* This rock has suffered much from denudation as is evident from the horizontal section on the beach; a large mass has been dislodged by the frosts of last winter and it is evident that after a number of years it will entirely

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* For a detailed notice of this place see *Journal of Geological Society Vol.* 1. p. 239.

disappear and the present picturesque appearance of this part of the section be materially affected or destroyed.

The distorted shale at Doctor's Brook contains fossils, but these are by no means abundant or of a superior grade. After a strict search I have found a bed of *Lingula* of two or three varieties, associated with a group of a small species of *Orthis*. In another place, I got the casts of a delicately striated shell resembling a compressed *Chonetes*, an impression of the aster of a small crinoid joint, and at some distance to the south I met with one or two *Lingula cuneata?* one specimen of which measures from the umbo to the base 9 lines, and a shell of a different kind, resembling in shape *Clidophorus concentricus*, but having the surface marking *reticulated*. I will take an early opportunity of transmiting the cast of this and duplicates of the others for determination. These fossils were found in situ, and they lie at right angles to the slaty fracture.

The masses of trap, the Frenchman's barn and the rugged crags at the mouth of Doctor's Brook, shew that in this region the volcanic action has been very violent and the fossiliferous strata have been so distorted that there is for a considerable distance southward no appearance of stratification remaining. The lofty banks of shale present this aspect until we reach a point in the brook where a Plutonic rock again appears, there is then an interval and the shale then appears to dip at a certain angle and in a uniform direction. This igneous rock appears to indicate the reason why the preceding strata have been so much shattered and distorted,—to shew that they have been subjected to the violent action of igneous forces before, beneath, and behind.

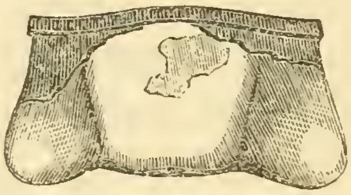
(*Note by Dr. Dawson.*)

[The observations recorded in the above paper by Rev. Mr. Honeyman are of much interest. They establish the continuation of the Arisaig line of outcrop to the East River, as suggested by me in my paper lately published in this Journal. They make known for the first time the occurrence of fossils at Lochaber Lake, in rocks supposed from their mineral character to be of the age of those of Arisaig and N. Canaan. The fossils found by Mr. Honeyman confirm this view, and probably also indicate the occurrence there of another and perhaps newer group, similar to that of Nictaux. The position of this place accords with the idea of a succession of anticlinal and synclinal folds pro-

posed in my paper. Mr. Honeyman has also apparently extended the Arisaig series downward by the discovery of fossils in the slates of Doctor's Brook, in which I have often searched in vain for such remains. I shall look with much interest for specimens from this place.

Among the fossils kindly sent to me with the paper, are some throwing new light on species previously imperfectly known, and others that are new to Nova Scotian Geology. The following especially deserve notice.

Fig. 1.



H. Dawsoni.

1. *Homalonotus Dawsoni,*—(Hall.) The caudal shield and portions of the articulations of the body, were the only parts known when the species was described by Prof. Hall. Mr. Honeyman now sends nearly perfect specimens of the head. It has the posterior border nearly straight, the glabella moderately prominent and slightly wider behind than before. It descends abruptly in front, and the frontal margin, which is absent in the specimen figured, appears to have risen in front of the glabella and eyes, with equal abruptness. The eyes are large and prominent, and advance into a line with the front of the glabella. Some of Mr. Honeyman's specimens shew that the species attained to a considerable size, at least three times that indicated by the head now figured. (Fig. 1 above.)

2. *Phacops Stokesii,*—(Edwards.) A cast of a head referable to this species, for notice of which and the closely allied *P. Orestes*, (Billings.) see Mr Billing's paper in Canad. Nat. vol. 5, pp. 65 and 66.

Of two other trilobites, fragments of which have been sent by Mr. Honeyman, one is according to Mr. Billings, a *Proetus*, the other a *Dalmania*, allied to *D. socialis.*

3. *Orthoceras exornatum*, N. s. This very prettily marked species is circular in its cross section, moderately tapering and straight, with siphuncle slightly eccentric, and septa half a line to a line apart, in a specimen two to four lines in diameter. The surface is slightly annulated and ornamented with about twenty-four flat longitudinal flutings in the manner of a Doric column. The whole surface is also delicately striated transversely. In

some respects it closely resembles *O. canaliculatum*, (Sow.) of the English Wenlock.

4. *Theca Forbesii*,—(Sharpe.) A little Pteropod in Mr. Honeyman's collection, appears perfectly identical with this species which is found in the Ludlow of England, and which resembles the *T. triangularis*, (Hall) of New York.

5. *Pleurotomaria*,—A flattish species with four turns, and interesting as being apparently the same with one common in the supposed equivalent of the Upper Arisaig group at Nictaux.

6. *Platyostoma*,—A species allied to *P. Niagarensis* of Hall.

7. *Bellerophon*,—Diameter, ¼ inch, carina prominent and broad, outer and umbilical slope of whorls steep and straightish, so as to give a somewhat rhomboidal cross section, surface with strong sharply waved transverse striæ, crossed by finer longitudinal striæ, cast of interior nearly smooth, with traces of transverse striæ. This shell much resembles Hall's *B. stigmosa* from the Clinton.

8. *Bellerophon*.—Two imperfect casts representing forms similar to *B. expansus* and *dilatatus*.

9. *Zaphrenitis*,—A cast not sufficiently perfect for specific determination, but not unlike imperfect specimens from the Devonian of Nictaux. This specimen is from Lochaber Lake.]

ARTICLE XLII.—*Note on a specimen of* Menobranchus lateralis, *taken at London, C. W.* By W. SAUNDERS, Esq.

Total length 4¼ inches; body 3 inches; tail 1¼ inches. Dull olive on the upper surface, the under of a dull, pinkish colour. A dark (not well defined) stripe, mottled olive and black, running from the head (where it is wide) to the tail, where it tapers off to a point. Broad stripes of the same character from the mouth along each side to the tail. The legs are very short, not quite half an inch long. On each foot there are four toes. The legs are olive with black spots, but the tips of the toes are of a light colour. The eyes are very small and not readily seen. The head is flat and almost triangular on its upper surface. The branchial plumes are six, three on each side, about an eighth o an inch long, and of a bright red colour which can only be seen when they are extended in the act of breathing.

The animal was found in the river Thames, close to this city between two and three months since, in a half torpid state, under a large stone. It was immediately transferred to my aquarium

where it has since been constantly under my eye. When first placed there, it at all times sought places of concealment, where it would remain for days without being seen, unless when forced, for a time from its hiding place. But several times at night when a light has been suddenly thrown upon the aquarium, I have observed it swimming about very actively. Within the last month its habits have somewhat changed. Up to that time I had never seen it eat anything. One day, however, while feeding the fish with some water insects, one came very near his mouth. The wave-like motion produced by the numerous legs of the insect attracted the attention of the Proteus. A newt standing very near, was also attracted by the movements of the insect. The sight was now truly interesting, both animals were just ready to seize upon the prey. The newt being the more active made the first movement and caught it by the tail, just at the moment when the Proteus was ready to seize it by the head. The Menobranchus not observing that the insect was already captured, opened its capacious mouth, and in attempting to seize it took the head of the newt as well as the little creature, into it. There they stood in mute astonishment. The Proteus evidently thought his eyes had much deceived him with regard to the size of the object of his attack, for he found his ample mouth well filled by the head of his companion. After the lapse of about half a minute, the newt showed symptoms of uneasiness, and began to wriggle about, when the Proteus let loose his hold, allowing the newt to escape unhurt, still holding the insect firmly in its mouth. This I concluded was his first attempt at feeding by day and rather a clumsy attempt it appeared to me to be. I immediately gave him a chance at another insect at the same time keeping his companions at a distance, which he succeeded in capturing. Since that time he has repeatedly eaten pieces of worms and young tadpoles, and although he grows more expert, his movements by day are still slow and awkward. Of late he seems to be gradually growing out of his retired habits, and although he sometimes now hides himself from view, still he may be frequently seen perambulating slowly up and down the bottom of the aquarium, as if in search of food. Before this change took place it was a rare thing to see him come to the surface for air, but now he rises many times a day.

About a month or six weeks since, I caught another animal of the same class, but of a different species or variety. I caught it while dredging a small muddy pond, (left by the subsidence of

the river) for the larvæ of dragonflies, and at the time I supposed it to be a newt. This animal was not more than an inch and a half, or two inches long, with the stripes on the body well defined, and of a purple or dark red colour. The branchial plumes, legs, and other parts of the body were proportioned, in about the same manner as in that last described, but it was a very much prettier animal. Unfortunately it died, and was partly eaten (I suppose by the cray fish) when I discovered it, otherwise I would have preserved it. I have made repeated attempts to procure another specimen but without success.

ARTICLE XLIII.—*On some new species of Fossils from the Limestone near Point Levi opposite Quebec.* By E. Billings.

On examining the specimens recently collected at this locality I find some evidence of several groups of species, each occurring in a rock somewhat different in appearance from that which contains the others. It does not seem improbable, judging from the fact that all the three varieties of limestone occur in close proximity to each other, that these species may yet be found more or less intermingled in the same beds, but for the present it is best to keep them separate. I shall designate the rocks simply as limestones Nos. 1, 2, 3, and 4. The genera collected in each are as follows.

No. 1. *Lingula*, 2 species. *Discina*, 1. *Agnostus*, 3. *Cono cephalites*, 1. *Arionellus*, 4. *Dikelocephalus*, 6. *Bathyurus*, 4. Total 21.

No. 2. *Dictyonema*, 1. *Lingula*, 1. *Orthis*, 2. *Strophomena*, 1. *Camerella*, 1. *Cyrtodonta*, 1. *Murchisonia*, 3. *Pleurotomaria*, 7. *Helicotoma*, 2. *Straparollus*, 2. *Patella*, 2. *Ecculiomphalus*, 2. *Orthoceras*, 5. *Cyrtoceras*, 4. *Agnostus*, 1. *Bathyurus*, 4. *Cheirurus*, 2. Total 41.

No. 3. *Asaphus*, 2.

No. 4. In a fourth mass of limestone imbedded in the cliff, near the ferry, a coral which resembles a *Tetradium* with very fine tubes and an *Orthis* of the type of *O perveta* were found.

One of the species of *Lingula* and apparently *Agnostus Orion*, are common to Nos. 1 and 2.

The following list gives the total number of species discovered in the several limestones above designated at this locality up to the present date.

	No. 1	21 species.
	2	41
	3	2
	4	2
		66
Deduct common to 1 and 2		2
	Total....	64.

The formation of slate and shale in which these limestones are imbedded, contains as I am informed, about thirty species of graptolites and other allied fossils; and besides these, two species of *Lingula*, an *Orthis*, a *Discina*, and a minute trilobite which will probably constitute a new genus.

The slates and limestones, according to the above, hold about 100 species, and it is more than probable that this number will be much increased by future discoveries.

In this paper I shall notice only the trilobites found in the limestones.

The other fossils appear to be nearly all new species and must remain over for another paper.

All the specimens described in this article were found in the conglomerate limestones near Point Levi opposite Quebec, and to save space I shall not repeat the locality after each description. It is not yet decided whether the fossils occur in the boulders of the conglomerate or in matrix.

AGNOSTUS AMERICANUS. N. S.

Fig. 1.—*a. b.*

Description.—Head oblong semi-oval, rather strongly convex, most elevated at the posterior one-fourth of the length, thence descending with a depressed convex slope in all directions to the sides and front; margin with a very narrow projecting border. The glabella is elongate oval; width, one-third that of the whole head; length, rather more than two-thirds the length of the head. It has two transverse furrows which completely or partially divide it into three segments. The anterior furrow extends all across at

one-third, or a little more, of the length from the front. The posterior furrow is interrupted in the middle and is only distinctly seen on each side, penetrating one-third the width, while its position is a little in advance of the posterior third of the length of the glabella. The space between the two inner extremities of the posterior furrows is occupied by a low conical tubercle, with the apex directed backwards. At each side of the glabella at the posterior extremity there is a small triangular lobe. The glabella is defined all round by a very narrow groove, just distinctly visible to the naked eye, and from the apex a similar groove runs straight to the middle of the front margin. The surface is ornamented by from fifteen to twenty irregular, slightly impressed, radiating rugose striæ.

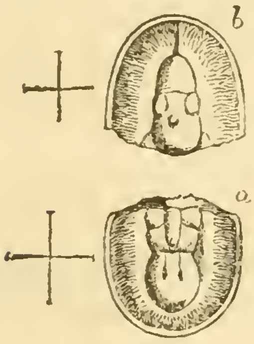


Fig. 1.

Fig. 2.

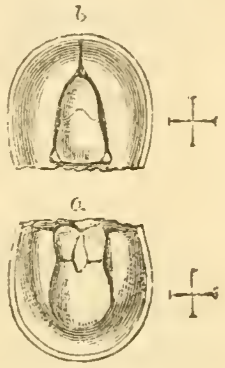


Fig. 3.

Fig. 1.—*Agnostus Americanus*; *a*, the tail; *b*, the head? Both a little magnified.

Fig. 2.—*Agnostus Orion*. Natural size.

Fig. 3.—*Agnostus Canadensis*; *a*, the tail; *b*, the head? Both magnified.

NOTE.—*All the figures in this article are of the natural size, unless otherwise specified.*

In the pygidium the posterior segment of the median lobe is equal to the two anterior in size; and there are no triangular lobes at the anterior margin. The tubercle is well developed, and its backward sloping apex reaches nearly to the posterior furrow. It seems to divide the two anterior segments so that each has a sub-quadrate lobe on each side. The surface is striated like the head. Two heads and one tail have been found.

Length of the tail three lines and one-fourth; of the largest head, three lines, and of the other two lines and three-fourths. The width is about equal to, or a little less than the length.

The contour appears to be not a regular semi-oval; the sides and terminal margins being only gently convex, and the angles broadly rounded.

The structure of the tail is similar to that of both *A. tardus* (Barrande) and *A. glabratus* (Angelin) but in these species the median lobe of the head is smooth and consists of one plate only, without furrows.

It may be that the tail above figured belongs to a different species, but even if that should be the case it is specially distinct from *A. tardus* and *A. glabratus*, for these are both smooth, while ours is striated like *A. exsculptus* (Angelin), and besides the proportions of the parts are sufficiently different to be of specific value, especially when the character of the surface is taken into account. *A. tardus* and *A. glabratus*, both belong to the upper part of the lower Silurian. *A. exsculptus* to Angelin's Region B, which is the upper division of the Primordial Zone in Sweden.

In Limestone, No. 1.

Agnostus Orion. N. s.

Fig. 2.

Description.—Length and breadth about equal, sub-circular, convex a very narrow margin all round, glabella not quite two thirds the whole length, very convex, a transverse furrow at one third the length from the apex, a small triangular tubercle at each side next the posterior edge; no tubercle visible on the top of the glabella. A fissure from the apex of the glabella to the anterior margin. Length two lines.

This species only differs from *A. pisiformis* as figured by Salter in the 3rd Edition of Siluria by having the glabella proportionally shorter.

Limestone, No. 1. In No. 2 there are two specimens of an *Agnostus* which resemble this species but more are required to decide whether they are identical or not.

Agnostus Canadensis. N. s.

Fig. 3.—*a. b.*

Description.—Head, obtusely oblong, semi-oval; width, a little greater than the length; a concave border nearly as wide as the glabella all round. Glabella in width, less than half the width of the head, and in length, a little more than two-thirds the length of the head; a triangular tubercle on each side at the neck, and a transverse furrow a little in advance of the mid-

length; the tubercle is obscure and appears to indicated by the small indentation forward in the middle of the transverse furrow.

The specimen represented by Fig. 3, *a*, is provided with a tubercle, but I cannot see in which direction the apex is directed, and consequently am unable to say whether it is a head or a tail. It has the broad margin of Fig. 3, *b*, and I think therefore it belongs to the same species. The segment next the thoracic extremity is a little less than one-third the whole length, and about one-third the whole width. The anterior segment is large and convex, extending quite to the concave border, where it is full one-half wider than it is at the suture between it and the smaller segment. The tubercle is situated in the transverse suture, and makes a small indentation in the edge of the larger segment.

Length of the specimens, about two lines.

Limestone, No. 1.

CONOCEPHALITES ZENKERI. N. s.

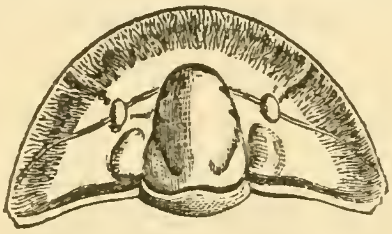


Fig. 4.

Fig. 4. *Conocephalites Zenkeri.*

Description.—Length apparently about two inches. Head very convex, nearly semi-circular with a strongly elevated thin sharp margin all round the front and sides, and just within this a wide deep uniformly concave furrow, the width of which is equal to about one third the length of the glabella. The posterior margin is strengthened by the neck segment which extends the whole width of the head, and becomes much elevated on approaching the outer angles. Glabella conical, very convex, most elevated at about the mid-length, with a well defined neck furrow, the posterior lateral furrows directed obliquely forwards at an angle of 45° with the longitudinal axis of the body, their inner extremities separated from each other by full one third the width of the glabella; the posterior lobes sub-triangular, their anterior angles situated at nearly one third the length of the glabella forward excluding the neck furrow and segment; the middle lateral furrows represented by a small depression or indentation on each

side situated on a line drawn across the head passing through the posterior half of the eyes; in front of these a much smaller indentation on each side representing the anterior furrows. The eyes are small and conical, situated on a line crossing the glabella at one half the whole length of the head, their distance from the glabella equal to one-third the width of the neck segment; ocular ridge extending from the eye forward to a point situated a little in advance of the anterior lateral indentation or furrow of the glabella. From the eye a strong ridge runs outwards to the margin of the head in two of the specimens, but in another it is not seen. Between the eye and the posterior margin and situated near the posterior lobe, on each side is a large sub-semicircular tubercle. This elevation is very slight in the small specimens. The surface of the glabella and cheeks adjacent thereto are apparently smooth but the whole of the concave border around the head is ornamented with fine rugose striæ distinctly visible to the naked eye.

Length of head in largest specimen seen eight lines; length of glabella six lines; width of head fifteen lines; width of glabella four lines; distance between the eyes six lines.

Thorax and pygidium unknown. I have not ascertained whether the posterior angles of the head are rounded or produced into spines.

Limestone No. 1.

Genus DIKELOCEPHALUS. Owen.

In the species which I have referred to this genus, the general form and aspect of the glabella and pygidium and the course of the facial suture are the same as in *D. Minnesotensis* the type of the genus specimens of which I have before me from the sandstone of the Western States. From numerous fragments of *D. Oweni* exhibiting the underside of the head, I have ascertained that the facial suture does not separate the cheeks from each other by cutting the fold of the margin. The head is therefore composed of three pieces only,—the glabella, hypostoma and united cheeks. This separates the genus from *Proetus*, some species of which, such as *P. striatus* (Barrande) have an expanded front margin and a spinose pygidium very like those of *D. magnificus*. The head of *Proetus* consists of five pieces. The hypostoma found associated with our specimens is much like that of *Proetus*, and it is also not unlike that of *Ogygia*. According to the figure given in

Siluria, plate 3, fig. 2, representing the sub-marginal fold of the cephalic shield, and the hypostoma attached thereto of *Ogygia Buchii*, the structure of the head of *Ogygia* must be the same as that of *Dikelocephalus*. The affinities of the two genera are still further indicated by the form of the glabella.

Dikelocephalus magnificus.

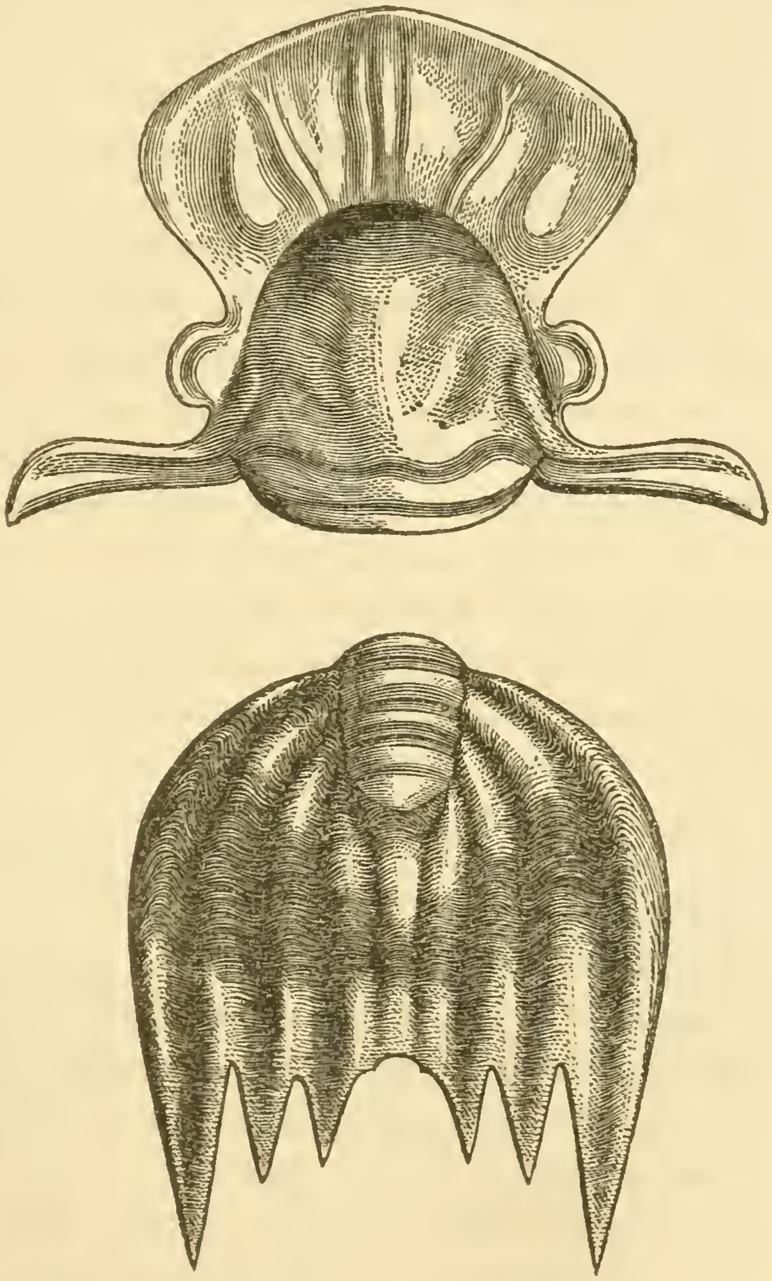


Figure 5.

Fig. 5.—Glabella and pygidium of *D. magnificus*.

Description.—Eight or nine inches in length. Head large with a short broad obstusely conical depressed convex glabella in front of which there is a broad flat margin with from five to eight obscure radiating ridges. The neck furrow is represented by an obscure shallow groove which is visible in the middle two

thirds of the width but dies out before reaching the sides of the glabella. In front of this there are from one to three shallow pits or faint depressions on each side of the median line representing the glabella furrows. A line drawn across the head at one third the length from the posterior margin would pass through the centres of the eyes nearly. The eyes are annular about one sixth the whole length of the head, situated their own length from the posterior margin and with their centres about the same distance from the side of the glabella. The facial suture runs from the inner anterior corner of the eye forwards and outwards at an angle of about 45° to the longitudinal axis of the body until it crosses a line drawn through the eye parallel with the axis of the body and having gained a point situated outside of this line at a distance from it equal to the length of the eye or thereabout it curves inward and reaches the front margin at a point somewhere near the line. It then appears to run round the margin. Behind the eye its course is, after a short inward and backward curve, directly outwards nearly parallel with the posterior furrow apparently one half the width of the cheek when it curves back and cuts the posterior margin before reaching the angle. On each side of the glabella nearly opposite but a little behind the position of the eye there is an obscure rounded elongated prominence.

Judging from several detached cheeks the posterior front of the head must be very wide and the angles produced into moderately long triangular spines.

The pygidium is somewhat fan shaped, the posterior margin terminating in six triangular points or spines, the outer ones of which are the longest and the inner ones diminishing in length so as to produce a semicircular emargination for the posterior outline. The greatest width of the pygidium is at about one third its total length from the front measuring to the extremity of the longest spine. In front of a line drawn across at this place the contour is nearly semicircular but behind the line the sides are straight or only gently convex and somewhat parallel slightly converging towards each other. The main body of the axis is about one fourth the total length, convex conical and with four shallow concave transverse grooves. Four ribs in each of the side lobes besides a rudimentary ridge along the middle being a continuation of the axis. The surface is marked by fine fissure-like undulating lines.

The pleuræ which seem to belong to this species are broad, flat, falcate and with a moderately strong groove running obliquely nearly their whole length.

Judging from the form of the three pygidia figured by Angelin on Plate 41 of the Palæontologia Scandinavica, it appears probable that this species connects *Dikelocephalus* with *Centropleura* a genus which occurs in the base of the Lower Silurian of Sweden, in Regio B and C of Angelin. It is perhaps an extreme form but the course of the facial suture and characters of the glabella are the same as they are in *Dikelocephalus*. The pygidium differs from *D. Minnesotensis* in having fewer ribs and a greater number of spines, but this difference is not of itself I think of generic value.

Limestone, No. 1.

DIKELOCEPHALUS PLANIFRONS. N. S.

Fig. 6.

Description.—Head with a broad smooth margin in front, the width of which is about equal to the width of the glabella: the latter oblong conical rather flat most elevated along the median line, broadly rounded in front, its sides nearly straight and sub parallel slightly converging from behind forwards. On each side of the median line there are three or four obscure depressions

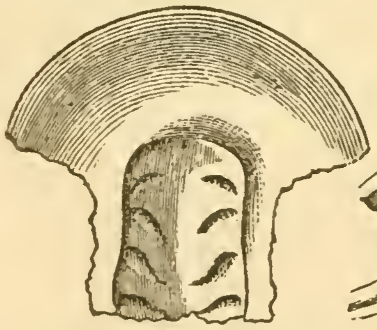


Fig. 6.

Fig. 7.

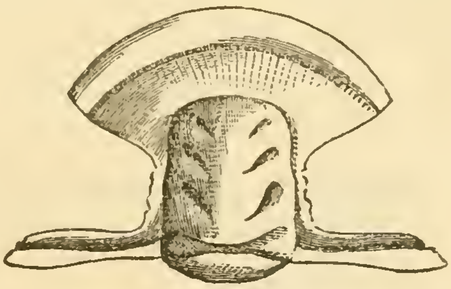


Fig. 8.

Fig. 6—*D. planifrons.*
Fig. 7.—*D. Belli.*
Fig. 8.—*D. Oweni.*

which represent the glabellar furrows. The length of the glabella appears to be about once and a half its width at the neck segment. Eyes, cheeks, thorax and pygidium unknown. Length of largest head seen, twelve lines; length of glabella, seven lines; width of glabella at base five lines, at front margin four lines and a half.

The head of this species differs from *D magnificus* in having a more elongated and depressed glabella with the wide border in front smooth instead of ornamented with radiating ridges.

Limestone, No. 1.

DIKELOCEPHALUS OWENI. N. S.

Fig. 8.

Description.—Head with a broad punctured and striated margin in front of the glabella; the latter oblong conical depressed, most elevated along the median line and with from two to four obscure depressions on each side representing the glabellar furrows. The front of the glabella is broadly rounded, the sides straight or nearly so, sub-parallel or slightly converging from behind forwards; the posterior margin straight in the middle, turned forward at the sides. At the base of the glabella there is an obscure transverse furrow and I am not sure whether this should be regarded as the posterior glabellar groove or the neck furrow. The front of the head is strengthened by a depressed convex rim just within which there is a curved row of punctures, four or five in one line. From these punctures fine somewhat flexuous striæ converge towards the front of the glabella. Eyes, cheeks, thorax and pygidium unknown.

Length of head of a specimen which appears to be of the average size ten lines; length of glabella, seven lines; width of glabella at neck segment, five lines and a half and at front margin four lines and a half; width of the marginal rim, one line and a half.

The depressions representing the glabellar furrows are sometimes obsolete and sometimes only one or two are visible on each side.

One of the specimens has the anterior striated margin proportionally one fourth narrower than the above and only five punctures in the width of one line. The glabella is smooth and not narrowed in front. I do not at present think, however, that these differences are of specific importance.

In another specimen where the crust is preserved the punctures are scarcely visible but where it is removed they are distinct.

Dedicated to Dr. D. D. Owen, whose extensive geological researches in the Western States have been of such great service to science.

Limestone, No. 1.

Dikelocephalus Belli. N, s.

Fig. 7.

Description.—Head semi-circular, the width apparently twice the length or a little more. Front margin surrounded by a narrow convex rim, distant about its own width from the front of the glabella. The latter is obtusely oblong, conical rather convex well defined all round by the narrow groove of the dorsal furrows, the sides nearly parallel, straight or nearly so, the front rounded. The neck furrow extends entirely across, nearly straight in the middle third and directed obliquely forward at an angle of about 45° at the outer third on each side. In front of this, two oblique glabellar furrows on each side, their inner extremities separated by about one-third the width of the glabella, forming three lobes of nearly equal size. The eyes appear to be situated opposite the second pair of furrows from the front, and to be distant from the glabella about one third the width of the neck segment.

Length of head of medium size, six lines and a half; length of glabella five lines and a half; width of the same at base four lines; a little narrower towards the front; width of marginal rim half a line; width of space between the marginal rim and the front of the glabella, half a line. Surface smooth.

Cheeks, eyes, thorax and pygidium unknown. Dedicated to Mr. Robert Bell, the discoverer of the genus in the Canadian rocks

Limestone, No. 1.

Dikelocephalus megalops. N. s.

Fig. 9.

Fig. 9.

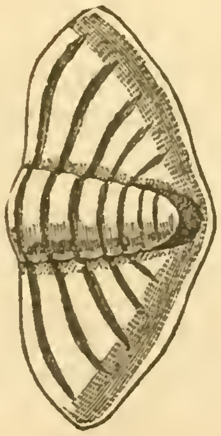


Fig. 11.

Fig. 10.

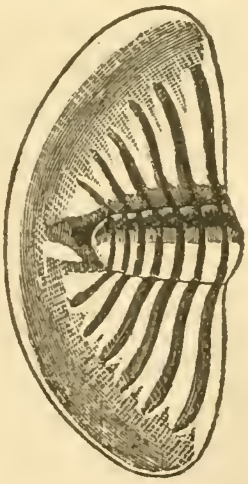


Fig. 12.

Fig. 9.—*D. megalops.*

Fig. 10.—*D. cristatus.*

Fig. 11. *and* 12.—*Pygidia* common in Limestone No. 1.

Description.—Head appearently semicircular ; anterior margin

strengthened by a narrow convex rim a little more than its own width from the front of the glabella, just within which is a curved row of punctures with fine striæ as in *D. Oweni.* Glabella elongate conical, depressed convex, front rounded, sides nearly straight, slightly converging from behind forward. Neck furrow straight in the middle, turned slightly forward towards the ends. In front of this two other short furrows on each side dividing the glabella into three lobes of which the anterior is the largest; the posterior furrows sometimes obscurely connected on the median line their outer extremities directed forwards at an angle of 45° with the longitudinal axis of the body; the anterior pair nearly at right angles but sloping a little forwards, their inner extremities not connected. On the front lobe there appear to be indications of a third pair of furrows on one of the specimens. The eyes are semi-annular, nearly half the whole length of the head, their anterior corners a little in advance of the outer extremities of the anterior glabellar furrow; their centres distant from the sides of the glabella, one third the width of the neck segment, their upper and lower angles, half that distance. Surface except the striated front margin apparently smooth.

Cheeks, thorax and pygidium unknown

Length of largest head seen five lines and a half; of glabella four lines and a half; width of glabella at neck segment three lines and a half nearly and at front furrows three lines.

Limestone, No. 1.

Dikellocephalus cristatus. N. s.

Fig. 10.

Description.—Small, head apparently semicircular; front margin with a strong rim abruptly elevated on its posterior edge and thence descending with a flat slope to the anterior edge, distant about its own width from the front of the glabella, with a row of punctures as in *D. Oweni.* Glabella oblong, front and sides somewhat straight, anterior angles rounded, neck segment and furrow well defined, no glabellar furrows. The glabella just in front of the neck furrow is abruptly elevated into a sharp rounded roof-shaped ridge from which it descends with a flat or gently concave slope to the front and lateral margins. Eyes very large, full one half the whole length of the head, their posterior angles close to the glabella at the neck furrow, thence they curve outwards so that their centres are distant from the sides of the

glabella rather more than one third the width cf the neck segment, thence more gradually curving inwards they reach the sides of the glabella (nearly) at a point a little in advance of its length.

Length of head in largest specimen seen four lines; of glabella about three lines; width of glabella at base two lines, a little narrower in front. Surface with the exception of the striated and punctured front, apparently smooth.

Limestone, No. 1.

Fig. 13.

Fig. 13.—The pygidium represented by Fig. 13, appears to belong to a species of *Dikelocephalus*, but the small fragment of stone in which it occurs resembles Limestone No. 2, in which no recognisable fragments of that genus have been found.

Genera.—ARIONELLUS (Barrande) and MENOCEPHALUS (Owen).

These two genera seem to be closely related and I shall therefore notice them collectively. In *Arionellus* the glabella is cylindrical or sub conical with three or four lateral furrows. The facial suture proceeds from the eye forward with a slight inward inclination to the front margin which it cuts on a line drawn between the eye and the glabella parallel with the axis of the body. Behind the eye it cuts the posterior margin at a point situated on a line drawn between that organ and the outer angle of the head. In the thorax of *A. ceticephalus* there are from 7 to 16 segments according to the age of the individual. The pygidium is small.

The head (all that is known) of *Menocephalus* only differs from *Arionellus* in having the glabella exceedingly convex. Owen discovered the glabella and a portion of the check plate but none of the other parts. He describes the former as being circular, highly arched hemispherical and pustulated. Judging from this description and the figure given by the author and also from the aspect of the associated fossils it appears to me highly probable that the species which I have called *M. globosus* is not only congeneric with Owen's *M. minnesotensis* but that it is closely allied thereto. *M. Sedgewicki* cannot be separated generically from

M. globosus and this latter leads us through *A. subclavatus* to *A. cylindricus.*

This latter appears to me to be an *Arionellus.* The specimens are too imperfect to enable me to prove whether or not our four species belong to two distinct genera or one only. I shall place the two most convex forms in *Menocephalus* and the other two in *Arionellus.*

ARIONELLUS CYLINDRICUS. N. S.

Fig. 14.

Fig. 15.

Fig. 14.—*Arionellus cylindricus.*
Fig. 15.—*Arionellus subclavatus: a*, side view of the glabella.

Description.—Glabella sub-cylindrical slightly narrowed from behind forwards, the sides nearly straight and separated from the very prominent cheeks by a deep furrow; the front obtusely rounded or nearly straight. The neck furrow is deep and rounded and the neck segment well defined but apparently not very prominent. The posterior glabellar furrow is well defined all across, parallel with the neck furrow for half the width of the glabella and then directed obliquely forward on each side at an angle of 45°; it is about its own width distant from the neck furrow. The next furrows forward are situated a little in advance of the mid-length of the glabella; they are slightly oblique and their inner extremities are separated by about one third the width of the glabella. In front of these are two other furrows on each side very inconspicuous and not always visible. The anterior margin of the head consists of a narrow elevated ridge separated from the front of the glabella by an angular groove of about its own width. From the summit of the terminal ridge the margin descends with an abrupt slope so that on a front view the head appears to be bounded by a flat nearly vertical band, the width of which is equal to rather more than one half the elevation of the glabella. The surface appears to be smooth or finely granular. Eyes, fixed cheeks, thorax and pygidium unknown. Length of longest head seen three and a half lines; width of glabella about two lines at neck segment and a little less at the anterior extremity. The form of the glabella of this species is almost exactly

like that of *Dikelocephalus granulosus.* (Owen). [See Geo. Rep. Wisconsin, Pl. 1, Fig. 7.]

Limestone No. 1, not common.

ARIONELLUS SUBCLAVATUS. N. S.

Fig. 15,—*a*.

Description.—Glabella as long as the head, separated from the front margin by a narrow groove only, strongly convex, and elevated in the anterior two-thirds, less convex, more depressed, and somewhat narrower in the posterior third; sides gently convex, nearly straight, sub-parrallel, slightly more distant from each other towards the front than behind, front obtusely rounded. The neck segment and furrow are rounded and well defined all across; the posterior glabellar furrows are rather strong, directed forwards at an angle somewhat less than 45°, their inner extremities separated by one-third the width of the glabella, and distant from the neck furrow about the width of the neck segment. In front of these are two obscure, nearly vertical furrows on each side, at about equal distances from each other. The fixed cheeks are strongly elevated, and separated from the glabella by the deep, narrow dorsal furrows. The eyes are small, and situated on a line drawn across the head, passing about midway between the two posterior glabellar furrows. They are connected with the front lobes of the glabella, by slender ocular ridges, as in the genus *Conocephalites.* The distance of the eye from the glabella, is a little more than half the width of the neck segment. The facial suture cuts the front margin, a little inside of a line drawn through the eye, parallel with the length of the body. Behind the eye it runs obliquely outward with a gentle curve, and cuts the posterior margin at a point between the line passing through the eye, and the posterior angles of the head. The surface in the large specimens is finely tubercular, but in the small ones apparently smooth. Length of largest head seen five lines and a half; the width of the glabella at one-third the length from the front, is about three-fourths of its own length, excluding the neck segment and furrow. Moveable cheeks, thorax and pygidium unknown.

Limestone No. 1.

MENOCEPHALUS SEDGEWICKI. N. S.

Fig. 16

Fig. 16.—*Menocephalus Sedgewicki.*

Fig. 17. Fig. 18. Fig. 19.

Fig. 17.—Side view of the head of *M. globosus.*
Fig. 18-—Upper surface of the head of *M. globosus.*
Fig. 19.—*Menocephalus globosus* front view of the head.

Description.—Glabella very convex, conical gradually tapering from the neck segment to the front, which is obtusely rounded. Neck segment and neck furrow-well defined all across. Two glabellar furrows on each side, which divide the glabella into three pair of lobes, the anterior pairs a little the largest, the other two nearly equal to each other. The posterior furrows sometimes curve so far backwards as to isolate the lobes from the body of the glabella; their depth, however, is inconsiderable. The glabella is separated from the cheeks and front margin, by the deep, narrow dorsal furrow which runs all round. The eyes are situated opposite the anterior glabellar furrows, and distant from the glabella about one-fourth the width of the neck segment. The front margin slopes from the front of the glabella downwards, and is then turned up to form a slightly elevated but well defined wire-like rim, which probably runs all round. Surface covered with small tubercles. Cheeks, thorax and pygidium unknown. Length of largest specimen collected four lines, length of glabella, including neck segment, three lines; width of, at neck furrow, two lines.

In some specimens a third glabellar furrow is represented by an obscure indentation close to the front.

The facial suture is evidently the same as in *A. cylindricus* and *A. subclavatus.*

Limestone No. 1.

MENOCEPHALUS GLOBOSUS. N. S.

Fig. 17, 18, 19.

Description.—Head globose, the posterior angles produced into small slender spines directed outwards, at an angle of about 45°, with the axis of the body. Glabella exceedingly convex, almost hemispherical, its length slightly exceeding its width; either totally destitute of lateral furrows, or with two inconspicuous indentations on each side. Neck furrow and segment well defined; the margin of the head with a narrow, wire-like border all round, which turns up in front of the glabella, and forms an obtusely pointed rostrum; cheeks moderately tumid, but drooping on each side, so as to give a great depth to the outline of the head. Eyes about one-fifth the total length of the head, situated opposite the mid-length of the glabella, and about their own width from it. Facial suture as in *A. subclavatus.* Surface covered with small tubercles. Width of head in the specimen figured five lines; length, three lines; length of glabella, two lines and one-fourth.

Associated with these are very numerous glabellæ of a larger size, in general four lines in length, which probably belong to this species.

Limestone No. 1.

Genus BATHYURUS. Billings.

This genus was described in the "Canadian Naturalist and Geologist," vol. 4, p. 364, in the article on the fossils of the Calciferous Sandrock. It differs from *Asaphus* by having nine segments in the thorax, the front of the hypostoma not forked, and the glabella well defined by the dorsal furrows. It somewhat resembles both *Megalaspis* and *Niobe* (Angelin), in the form of the glabella, but the hypostoma is precisely like that of *Ogygia.* I have some evidence to shew that the head is composed of three pieces only, as in *Dikelocephalus.* The species heretofore described are, *B. amplimarginatus*, *B. conicus*, and *B. Cybele*, from the Calciferous Sandrock:—*B. Angelini*, Chazy:—*B. extans*, (*Asaphus extans*, Hall,) as yet known only in the Black River limestone, and *B. spiniger*, (*Acidaspis spiniger*, Hall.) This latter species occurs both in the Black River and Trenton, in Canada.

The following species are referred to this genus provisionally. I am not at all satisfied that they belong to the genus, but I know of no other to which they bear so near a resemblance.

BATHYURUS CAPAX. N. S.

Fig. 20.

Description.—Head, convex, forming a depressed quarter of a sphere. Glabella oblong, separated from the flat, sloping rim of the front margin by a narrow angular groove; sides gently concave, nearly straight, with a short obscure outward curve opposite the eye, slightly converging towards each other from behind, forwards. The neck furrow is represented by an obscure transverse impression, which occupies the middle third of the width of the glabella, but does not reach all across. The anterior and posterior angles are rounded, and although distinctly defined all round, by the dorsal furrows, (which, however, are only slightly impressed), the glabella in the anterior half, is scarcely at all elevated above the general convexity of the head; it is moderately prominent behind. The eye is situated at mid-length of the head, semi-annular, its centre distant from the side of the glabella, two lines, when the length of the head is thirteen lines.

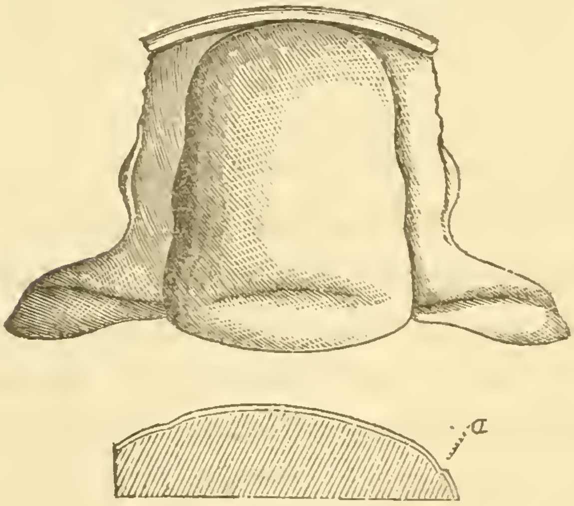


Fig. 20.

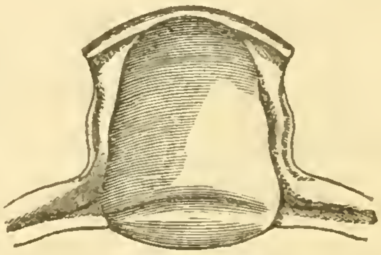


Fig. 21.

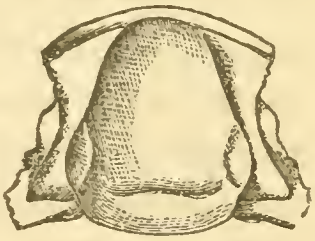


Fig. 22.

Fig. 20.—*Bathyurus capax.* The lower figure is a longitudinal section, shewing the convexity of the glabella and the flat sloping rim of the front margin at *a*.

Fig. 21.—*Bathyurus dubius.*

Fig. 22.—*Bathyurus bituberculatus.*

The anterior margin of the head to front of the glabella is strengthened by a flat rim, which slopes downwards and forwards at an angle of about 60°, with the horizontal plane of the body. This character is constant in heads specimens of all sizes, from a length of six lines to thirteen. The width of this rim in

the largest specimens, is one line and one-third. Cheeks, thorax and pygidium, unknown. Surface apparently smooth.

Length of large head, thirteen lines; width of glabella, at base, nine lines, and at two lines from the front margin, eight lines.

Limestone, No. 1.

Bathyurus dubius. N. s.

Fig. 21.

Description.—This species differs from *B. capax* in having the glabella more pointed, and narrowly rounded in front, and the marginal rim not flat but of a sub-cylindrical wire-like form.

Length of head in largest specimen seen, nine lines; width of glabella at neck furrow, six lines and a half, and at two lines from front margin, five lines.

Limestone, No. 1.

Bathyurus bituberculatus. N. s.

Fig. 22.

Description.—Glabella the same as in *B. dubius*, but more pointed in front, and with an elongate-oval tubercle or lobe on each side of the posterior half. These tubercles are of an elongate oval form, pointed at both ends, bounded on the outside by the dorsal furrow which runs all round the glabella, and on the inside by a shallow, rather obscure groove, but which seems to separate them completely from the main body of the glabella. The lower pointed extremity of each, terminates a little below the level of the neck furrow, and the upper, a little behind the mid-length of the head.

Length of largest head seen, eight lines and a half; width of glabella just behind the neck furrow six lines; length of each tubercle two linees and a half; width of same in the middle one line. Surface smooth.

Limestone, No. 1.

Bathyurus armatus. N. s.

Fig. 23.

Description.—Head very convex, with a strong broad-based spine projecting backwards from the neck segment. The contour of the glabella is obscurely indicated by two faint grooves which

appear to die out before reaching the front margin. It appears to be regularly conical, but scarcely at all elevated above the general convex surface of the head. Length of head in the specimen figured excluding the marginal rim, which is unknown, nine lines. Width of glabella at base, six lines; at about the middle of the head, five lines; the length of the spine is unknown. Surface smooth.

Limestone, No. 1.

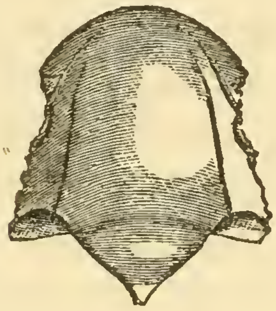


Fig. 23.

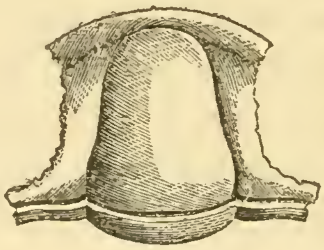


Fig. 24.

Fig. 25.

Fig. 26.

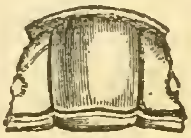


Fig. 27.

Fig. 23.—*Bathyurus armatus.*
Fig. 24.—*Bathyurus Saffordi.*
Fig. 25.—*Bathyurus oblongus.*
Fig. 26.—*Bathyurus Cordai.*
Fig. 27.—*Bathyurus quadratus.*

BATHYURUS SAFFORDI. N. S.

Fig. 24.

Description.—Glabella conical convex, much elevated above the general surface of the head, front angles rounded, sides somewhat straight in the anterior half, below which they curve a little outwards, and become paralled for a short distance next the posterior margin. The neck furrow in the cast of the interior is well defined all across, but when the crust is preserved it dies out on approaching the sides. The rim which forms the front margin has a flat slope inwards to the anterior edge of the glabella.

Length of largest head seen, eight lines and a half; width of glabella at neck segment, six lines, and at two lines from the front, three lines and a half. Surface smooth.

Dedicated to Professor J. M. Safford, State Geologist of Tennessee.

In Limestone No. 2.

BATHYURUS OBLONGUS. N. S.

Fig. 25.

Description.—The glabella of this species is oblong, convex with nearly parallel sides, well separated from the cheeks by the deep dorsal furrow, the front rounded, and the neck furrow rather deep all across. The eyes are small, situated a little behind the mid-length of the glabella, and distant from the dorsal groove a little less than one half the width of the neck segment. The marginal rim of the head is the same as in *B. Saffordi.* Surface smooth. Length of glabella four lines; width three lines.

Limestone, No. 2.

BATHYURUS CORDAI. N. S.

Fig. 26.

Description.—Glabella conical, with a deep sulcus all round; in front an elevated rim apparently forming a rostrum similar to that of some species of *Calymene*; just within the rim a deep groove, between which and the furrow that surrounds the glabella, there is a rounded ridge. Neck furrow well defined all across. Eyes apparently about opposite the middle of the glabella. Surface smooth.

The glabella in some of the specimens is more narrowed towards the front than it is in the specimen figured.

Length of largest head seen, seven lines; length of glabella, five lines; width just in front of the neck furrow, three lines and two-thirds; at one line from the front, three lines.

Limestone, No. 2.

BATHYURUS QUADRATUS. N. S.

Fig. 27.

Description.—Glabella oblong, convex, only slightly rounded in front, well defined all round by the dorsal furrows, the sides straight and parallel, the eyes are small, and situated as in *B.*

oblongus, an ocular ridge obscurely visible in one specimen. Neck furrow well defined all across.

Length of glabella four lines; width three lines and a half.

Limestone, No. 2.

CHEIRURUS APOLLO. N. s.

Fig. 28.

Description.—Head convex, semicircular, width about twice the length or a little more. Glabella depressed, convex, somewhat circular or very broadly conical, the posterior margin convex, the sides and front rounded, the width at the posterior third equal to the length, the neck furrow in the cast defined all across three glabellar furrows directed obliquely forwards and outwards at an angle of about 30°, with the longitudinal axis, their inner extremities turned backwards, and distant from each other about one-fourth the whole width. The four side lobes of the glabella

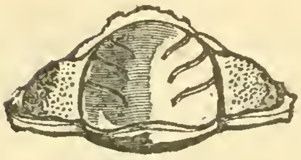


Fig. 28.

Fig. 29.

Fig. 30.

Fig. 28.—*Cheirurus Apollo.*

Fig. 29.—*Pygidium.* Limestone No. 2. This may be the tail of an *Amphion.*

Fig. 30.—*Cheirurus Eryx.*

are sub-equal, the posterior pair a little larger than the others. Eyes small, opposite the second lobe from behind, distant from it about the width of the lobe or a little less. Cheeks in the cast punctured. I have not ascertained whether or not the posterior angles terminate in spines. Length of head, five lines; length and width of glabella, a little less than five lines.

There are many European species of this type, and they range from the Landeilo Flags upwards to the Devonian.

Limestone, No. 2.

CHEIRURUS ERYX. N. s.

Fig. 30.

Description.—Head semicircular, depressed convex, width twice the length or a little more, the posterior angles produced into short spines. Glabella elongate conical, moderately convex,

rounded in front, sides nearly straight or gently convex, neck furrow well defined all across, and continued on the cheeks to the outer angles of the head, four lobes on each side of which the anterior is largest, the posterior smallest, and the other two almost equal to each other, the furrows directed obliquely forwards at an angle of about 30°, to the longitudinal axis, their inner extremites distant from each other a little less than one-third the width of the glabella. Cheeks moderately convex, punctured. Eye opposite the second lobe from the front, and distant from the glabella apparently about the width of the lobe.

Length of head nearly four lines ; of glabella, about three lines and a half; width of glabella two lines and a half.

Limestone, No. 2.

Closely allied to a small species which occurs in the Chazy limestone at Caughnawaga. Another of the same size and type occurs at Phillipsburgh.

Asaphus Illaenoides. N. s.

Description.—Head very convex, in shape like that of an *Illaenus*, equal to about one-fourth of a sphere, posterior angles rounded; width a little less than twice the length. Glabella obscurely defined, oblong, slightly narrowed just behind the eyes, thence a little widened both forwards and backwards. Eyes subglobular, of a medium size, close to the glabella, the distance between their centres about equal to the length of the head. The facial suture runs from the inner anterior angle of the eye, with a scarcely perceptible curve outwards, directly forward to the front margin, being in this part almost parallel with the longitudinal axis of the body. From the inner posterior angle it runs outwards aud backwards, and cuts the margin at a point in a line drawn parallel with the axis of the body, passing outside of the eye at a distance therefrom equal to one-half the width of that organ. The cheeks from the eye to the posterior angle of the head, descend with a flat slope of about 45° to the horizontal plane of the body. The surface appears to be smooth.

The pygidium is depressed, convex, semicircular, the posterior margin regularly rounded; the axis depressed, semi-cylindrical, sub-conical, sides a little concave rather prominent, the extremity very obtusely rounded, the length varying from a little more than one-half to two-thirds the total length ; its width a little less than that of the side lobes, five very obscure segments of

which the last two are sometimes blended into one. The anterior margins of the side lobes are almost at right angles to the axis for one-half or thereabouts of the width, then sloping backwards to the outer corners, which they reach at an angle of about 30° to the transverse diameter of the body.

Just behind the margin there is a single groove, obscure towards the axis but more distinct outwards. There are in some specimens, several faintly marked ribs, but in general the side lobes, with the exception of the anterior furrow, are smooth.

Length of head of a specimen of medium size, seven lines width, twelve lines; distance between centres of eyes, seven lines.

Length of a pygidium of medium size, six lines; width, twelve lines; length of axis, four lines and a-half; width of same at front margin, three lines and a half, and at half a line from the posterior extremity, three lines.

I have seen the underside of the head of this species and the sub-rostral fold is distinctly divided as in *A. platycephalus* Had not this character been observed, I would have, without much hesitation, referred the head to the genus *Illænus*.

In Limestone No. 3.

Asaphus Goniurus. N. s.

The above name is proposed for a small triangular pygidium found in No. 3. It is evidently distinct from any described Silurian species of this country, but allied to one that occurs in the Chazy Limestone at Mingan. The form is triangular, the length three-fifths, or thereabouts, of the width, the axis scarcely at all elevated above the surface, and indistinctly divided into segments in the anterior half, but towards the extremity becoming strongly elevated, smooth and pointed. The largest specimen seen is about half an inch in length. It resembles t e tail of a small *Homalonotus*.

Limestone No. 3.

MISCELLANEOUS.

THE OIL WELLS OF MECCA.

by Dr. J. S Newberry.

Within the past week I have made a pilgrimage to Mecca, somewhat to my edification, and now perhaps you would be interrested in a very brief description of this newly found "city of the *profit*."

This modern Mecca is, as you are perhaps aware, situated near the centre of Trumbull county, ten miles north-east of Warren. Till recently—like so many towns on the Reserve, and their prototypes, the farming towns of New England—simply the pleasant and very quiet home of a peaceful and thrifty rural population. In March last, however, the Oil Springs, which had been well known to the inhabitants for fifty years, and from their contaminating influence on the water, regarded as anything but a blessing—attracted the attention of some Pennsylvanians, whose eyes had been opened by the wonders of Oil Creek. These parties leased from the proprietors most of the lands in the vicinity of the springs and wells containing oil. In the face of general incredulity and much ridicnle, a well was bored at Powers' Corners by Messrs. Burnell, Jordan & Woods, and a pump set in it some six weeks since. This has continued to discharge three or four barrels of oil daily, from that time to the present, silencing ridicule but producing little excitement.

Many were encouraged to bore on their lots, and two weeks ago to-day the second pump was put in operation. This was owned by two Germans who were quite poor, and who had struggled on, nearly discouraged, until their somewhat rude machinery could be put in motion. With the first stroke of the pump the oil began to flow, as it has done steadily since, at the rate of about twenty-five gallons per hour, or from 12 to 16 barrels per day. The proprietors are raised from their poverty and despondence to a point far above their wildest hopes. After seeing the oil flowing in a copious and steady stream, and the triumphant success of the experiment demonstrated, one of them turned to the crowd, and carried away by his feelings, said, "I tell you now, gentlemen, if

a poor man comes and asks me for a thaler, I gifs him a tausend" —a generosity to which his newly found affluence will doubtless prove a complete antidote.

A few days later, one of our citizens, who was there, asked him in mere curiosity if he would sell the well for $15,000, but he was not to be dazzled by any such trifling sum, and said that four times that amount was the least offer worth considering. When it is remembered that his well is daily paying over $150 profit, his valuation will scarcely seem extravagant.

These two are the only wells in which pumps have as yet been placed, but at least fifty others have been bored in their vicinity in which oil has been found in considerable quantity—sometimes more than five barrels having been raised in the sand pump, and saved during the process of sinking the auger fifty feet—a fact which certainly augurs well for the richness of the district.

This oil is dark, thick, tarry looking stuff, very much like that from the Titusville wells, but has almost no unpleasant odour, and has proved on trial to be readily refined, and to be fully equal both as a lubricator and illuminator to the best samples from Pennsylvania. It is perhaps yet too early to make a just comparison between the Mecca and Titusville oil regions, as the former is not yet fully explored, nor has the productiveness or permanance of its oil springs been fairly tested. The quality of the oil is however, not inferior, and the present indications of its quantity are quite as promising as they were on Oil Creek, at a similar period in the developement of the wealth of that region.

In one respect the proprietors of the wells in Mecca have a decided advantage over those of Pennsylvania—in the greater accessibility of their oil. The most copious flow has been found within fifty feet of the surface, and the rock is so easily penetrated that a well may generally be sunk to that depth within a week and at a cost of fifty dollars. To fit it for the reception of a pump something more is necessary, but the entire expense is comparatively trifling.—*Cleaveland Paper.*

REVIEWS AND NOTICES OF BOOKS.

Report of the Geological Survey of Canada for the year 1858.

We should have noticed this Report some time ago, but for a press of other matter ; and now we can but give a summary of its

contents, referring the reader to the publication itself, which has been very properly placed in the book-stores for sale.

First, we have the continuation of Sir W. E. Logan's exploration of the beds of Laurentian limestone; from which it appears that four important bands of crystalline limestone have now been traced for considerable distances through this contorted and altered series of strata. The aggregate thickness of all these limestones appears to be no less than 4000 feet, and so far no certain indications of fossils have been discovered in them.*

Another portion of Sir William's Report, very valuable at present, is a summary of the latest facts relative to the metalliferous deposits of Canada, and especially the copper deposits of the Eastern Townships. This part of the Report, as well as the tabular view of the localities in the Appendix, should be studied by every one interested in these deposits.

Mr. Murray's portion of the Report, more fully unravels the intricacies of another cupriferous region, that of Georgian Bay. Mr. Richardson describes the relations of the deposits in the peninsula of Gaspé and the neighbouring shores of the St. Lawrence. Mr. Sterry Hunt contributes a series of examinations of the mineral and chemical constituents of the igneous and altered rocks which penetrate the Silurian series in Lower Canada, and form the mountains of Montreal, Belœil, Rougemont, Mount Johnson, &c., with similar observations on the intrusive masses which have pierced the Laurentian rocks of Grenville and Chatham. We have also a series of examinations of the minerals of the altered sediments of the various series, including the gneissose epidotic and chloritoid rocks. His researches on the formation of gypsum and magnesian rocks, commenced in a previous report, are here brought to a close, and put us for the first time in possession of a simple and satisfactory explanation of the origin and formation of these deposits.

In the appendix to the report is a very valuable catalogue of the animals and plants collected by Mr. D'Urban in the counties of Argenteuil and Ottawa. This, and the catalogue of Lepi-

* In a limestone probably of this age from Madoc, the carbonaceous matter present is arranged in a manner which conveys the impression on microscopic examination that it must have formed part of organic tissues, and in slates associated with this limestone we have observed cylindrical perforations resembling the *Scolithus* of the Potsdam sandstone.

doptera in the present number, are the last services Mr. D'Urban is likely to render for the present to Canadian science. He is now on his way to another field at the Cape of Good Hope, we wish we could say soon to return to us.

Mr. Bell contributes a long and useful catalogue of the animals and plants of the Lower St. Lawrence ; and he, we are glad to say, is this summer in his old field.

The Zoologist, *June*, 1860.—*Van Voorst*, *London.*

We have to thank the editor of this Journal for his kindly regard to our wish for an exchange, and his favourable notice. The *Zoologist* is a popular magazine of Natural History and a Journal for recording facts and anecdotes relating to animals. The present number contains among other matters very interesting notices of the labors of M. Monhet, a collector at work in Siam; papers on the habits of the Aye-aye, on the Fauna of Mull, and on beetles of the family Trichopterygidæ, with a great variety of interesting notices of new discoveries and incidents in Natural History.

Specimens of Marine Algæ : chiefly from England. Presented to the *Natural History Society* of Montreal. By Dr. Durkee, Boston.

This volume contains a large number of specimens neatly prepared and carefully named. Many of them are from the herbarium of Dr. Harvey of Dublin, than whom there is no higher authority in this department of Botany. The collection affords a ready means for the determination of species to those few students of Natural History in this Province, who take an interest in this humble but exceedingly beautiful and interesting subkingdom,—the sea-weeds. Some fine specimens of the more obscure plants are embraced in this book ; many of which are not to be found in ordinary collections. There are some good examples of the less common Fuci; but the largest number pertains to the class of Rhodosperms, Polysephoniæ, and Calithamnia which are finely illustrated. Interspersed among the prevailing English species, we find some plants from Australia, and a few natives of America. Altogether this is a valuable gift by one of the corresponding members of our Society. We trust that it will form the nucleus of a complete collection of this beautiful class of plants. The Lower St. Lawrence is particularly rich in its genera and species of Algæ, and it may be hoped that some careful collector will supplement Dr. Durkee's gift by a corresponding book of our native sea and river flora.

MONTHLY METEOROLOGICAL REGISTER, ST. MARTINS, ISLE JESUS, CANADA EAST, (NINE MILES WEST OF MONTREAL,) FOR THE MONTH OF JUNE, 1860.

Latitude, 45 degrees 32 minutes North. Longitude, 73 degrees 36 minutes West. Height above the level of the Sea, 118 feet.

BY CHARLES SMALLWOOD, M.D., LL.D.

Day of Month.	Barometer—corrected and reduced to 32° F. (English inches.)			Temperature of the Air.—F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.			Direction of Wind.			Horizontal Movement in 24 hours. In miles.	OZONE. Mean amount of, in inches.	RAIN. Amount of, in inches.	SNOW. Amount of, in inches.	WEATHER, CLOUDS, REMARKS, &c. &c. [A cloudy sky is represented by 10, a cloudless one by 0.]		
	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.					6 a. m.	2 p. m.	10 p. m.
1	29.571	29.603	29.722	58.5	67.1	86.1	.423	.373	.279	.88	.54	.84	N.	N. E. by N.	E. by N.	153 50	2.0	....	....	Cu. Str. 8.	Cu. Str. 4.	C. C. Str. 8.
2	758	580	609	44.9	70.7	58.9	.211	.470	.358	.72	.52	.73	S. E.	S. S. W.	E. by E.	10.88	2.0	....	....	Fog.	Cum. 2.	Clear.
3	679	523	528	54.5	79.6	69.4	.328	.501	.430	.77	.51	.61	E. S. E.	S. by E.	S. by E.	62.80	1.0	....	....	Heavy Dew Clear.	Clear.	"
4	420	301	281	64.1	84 7	69.4	.373	.476	.430	.62	.42	.61	S. by E.	S. S. E.	S. S. E.	114.10	1.0	....	....	" " "	Hazy.	"
5	242	271	406	66.4	69.2	63.2	.451	.402	.478	.78	.65	.83	S. E. by E.	S. S. E.	S. by E.	191.50	2.0	....	....	C. C. Str. 9	C. C. Str. 10.	Cu. Str. 10.
6	468	396	438	60.0	79.2	67.0	.456	.405	.463	.88	.47	.71	N. E. by E.	N. E. by E.	N. E. by E.	62.80	2.5	....	....	Clear.	Clear.	Clear.
7	399	304	312	62.9	78.9	63.0	.179	.507	.478	.66	.52	.83	N. E. by E.	N. E. by E.	W. by S.	126 60	2.0	....	....	"	"	Nim. 10.
8	322	314	384	59.0	68.6	89.1	.410	.457	.410	.82	.69	.82	S. S. W.	S. by W.	S.	215.70	2.0	0.562	....	Cu. Str. 10.	St. 2.	Clear.
9	419	417	471	55.0	69.9	57.0	.370	.456	.359	.84	.63	.73	S. by W.	W. by N.	N. W.	119.90	1.5	....	....	" 10.	Cu. Str. 4.	Cu. Str. 9.
10	493	537	624	53.1	89.5	56.6	.321	.433	.357	.80	.65	.79	N. W.	N. W.	N. by W.	124.60	4.0	Inapp.	....	" 4.	Nimb. 10.	" 8.
11	641	628	724	54.1	73.5	62.4	.335	.338	.453	.80	.41	.80	N. by W.	N. by E.	N.	134.10	1.0	....	....	Clear.	Clear.	Clear.
12	752	854	783	50.4	80.1	65.4	.265	.567	.509	.75	.57	.81	E. by S.	S.	E. S. E.	15.10	1.5	....	....	"	"	"
13	870	748	800	62.0	90.9	71.0	.489	.744	.442	.75	.52	.59	E. by S.	S. E. by E.	S. E.	122.20	2.5	....	....	"	"	"
14	801	763	770	69.0	91 0	71.0	.496	.536	.503	.70	.37	.66	S. W. by S.	S. W.	S. W. by E.	37.00	1.0	....	....	"	" Solar Halo.	C. Str. 2.
15	730	700	707	65.4	85.0	84.2	.483	.577	.897	.78	.49	.53	S. S. W.	S. W.	W. S. W.	10.50	1.5	....	....	"	Cir. 4. Solar Halo.	C. C. Str. 4. distant lightning.
16	814	824	906	63.0	82.1	65.6	.422	.610	.542	.75	.56	.87	S. E.	N. E. by E.	N. E. by E.	84.90	2.5	Inapp.	....	Cu. Str. 4.	Cu. Str. 4.	" " "
17	884	914	986	64.0	89.4	61.2	.483	.894	.464	.73	.64	.77	N. E. by E.	S. E. by S.	S. E. by E.	105.10	2.5	....	....	Clear.	C. C. Str. 2.	Cu. St. 2.
18	886	738	728	70.0	84.5	71.0	.586	.584	.572	.80	.50	.66	S. E.	S. E.	S. E. by E.	28.70	2.0	....	....	"	Cu. Str. 4.	" 8.
19	604	601	614	66.0	78.4	59.1	.542	.664	.439	.87	.69	.98	S. E. by E.	S. S. E.	N. E.	0.50	2.0	0.403	....	"	C. Str. 2. dist. thunder	" 10.
20	894	614	717	58.2	52.1	54.2	.446	.460	.390	.90	.85	.93	N. N. E.	N. E. by E.	N. E. by E.	249.90	3.0	0.271	....	Cu. Str. 10	" 10.	Rain.
21	914	924	941	52.7	72.9	60.1	.328	.390	.367	.83	.50	.71	N. E. by E.	N. N. E.	S. E. by E.	157.10	3.5	0.600	....	" 8.	Clear.	Clear.
22	974	957	914	62.0	82.6	65.0	.406	.604	.490	.74	.54	.81	S. S. E.	N. N. E.	N. W. by W.	33.10	2.0	....	....	Clear.	C. C. Str. 4.	"
23	904	900	30.000	61.5	77.2	63.0	.449	.587	.517	.85	.63	.91	W. S. W.	E. S. E.	S. W. by W.	28.50	1.5	Inapp.	....	C. C. Str. 10.	C. Str. 10. dist. lt'ing.	Cu. St. 2.
24	30.114	30.101	104	61.1	85.5	66.1	.464	.570	.502	.77	.47	.78	S. S. E.	S. S. W.	S. S. W.	13.80	1.5	....	....	Clear.	Clear.	" 4. comet visible.
25	059	004	29.930	66.3	83.0	72.1	.536	.558	.631	.84	.50	.81	S. S. W.	W. S. W.	W. S. W.	80.60	1.5	....	....	"	"	Clear.
26	29.847	29.899	897	69.3	79.7	68.6	.635	.606	.483	.80	.60	.78	W. S W.	W. S. W.	N. by W.	76.35	3.0	0.597	....	Cu. Str. 10.	C.C. Str. 4.	Cu. St. 10.
27	30.021	940	501	60.3	79.7	61.6	.426	.644	.390	.82	.64	.74	N. E.	W.	W. S. W.	89.60	1.5	....	....	Clear.	Clear.	" 4.
28	29.807	745	543	64.2	72.8	71.1	.464	.355	.572	.77	.32	.76	S. W.	W. S. W.	S. S. W.	108.10	1.9	Inapp.	....	"	Cu. Str. 4.	C. C. Str. 4.
29	470	367	538	76.3	77.0	72.1	.652	.799	.771	.73	.86	.95	S. W. by S.	W. by N.	S. S. W.	149.90	3.5	0.116	....	Cu. Str. 4.	" 10.	" 4.
30	550	597	754	70.2	78.4	65.0	.628	.342	.307	.88	.36	.51	S. W.	W. by S.	W. N. W.	158.30	2.0	....	....	Clear.	Clear.	Cu. St. 8.
...	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	....	......	....	....	....	....	....

REPORT FOR THE MONTH OF JULY, 1860.

Day of Month.	Barometer—corrected and reduced to 32° F. (English inches.)			Temperature of the Air.—F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.			Direction of Wind.			Horizontal Movement in 24 hours. In miles.	OZONE. Mean amount of	RAIN. Amount of, in inches.	SNOW. Amount of, in inches.	WEATHER, CLOUDS, REMARKS, &c. &c. [A cloudy sky is represented by 10, a cloudless one by 0.]		
	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.					6 a. m.	2. p. m.	10 p. m.
1	29.867	29.817	29.866	61.0	74.1	60.5	.325	.568	.338	.61	.67	.65	S. W.	W. by N.	W. by S.	34.64	1 0	....	....	Clear.	Cir. 4.	Clear.
2	899	822	841	52.6	81.6	63.2	.354	.638	.386	.90	.83	.67	W. S. W.	N.W. by W.	S. by W.	22.20	1 5	....	....	"	"	Cu. Str. 4.
3	794	693	635	65.0	86.3	71.0	.389	.448	.592	.63	.36	.76	S. by W.	S. W.	S. by W.	252 60	1.0	....	....	"	C. C. Str. 8	Cirr. Str. 8. Comet seen.
4	697	712	687	61.1	76.1	59.0	.413	.273	.317	.77	.30	.63	E. S. E.	E. S. E.	S. S. E.	83.40	1.0	....	....	"	Clear.	C. C. Str. 10. Hazy.
5	519	675	797	57.2	75.9	58.2	.322	.477	.394	.69	.54	.82	N. E. by E.	S. E. by S.	W. S. W.	20.00	1.0	....	....	Cu. Str., 10.	C. C. Str. 4.	Str. 2.
6	695	814	870	65.1	83.2	62.7	.366	.376	.416	.60	.35	.72	S. E. by S.	E. S. E.	S. E.	97.00	1.5	....	....	Clear.	Clear.	Clear.
7	885	840	818	67.0	85.8	66.0	.489	.487	.431	.75	.40	.66	S. E.	S. S. W.	S. S. E.	45.00	1.5	....	....	"	" Thunder.	Cirr. 4.
8	751	644	521	58.6	81.6	66.9	.423	.362	.196	88	.34	.77	S. S. E.	S. S. E.	S. by E.	169.60	2.0	....	....	" heavy dew.	"	Cu. Str. 6.
9	306	353	531	69.8	77.6	67.7	.665	.608	.556	.92	.67	.84	S. S. E.	S. W.	W. S. W.	231.20	3.0	0.330	....	Rain.	Cu. Str. 10.	" 8.
10	882	741	742	57.0	64.1	57.0	.350	.464	.429	75	.77	.91	S. W. by W.	W. by N.	W. by S.	224.70	3 0	....	....	Cu. Str. 8.	C. C. Str. 10.	" 2.
11	862	830	872	52.1	68.9	57.8	.308	.313	.282	79	.45	.88	W. N. W.	N. W.	N. N. W.	233.60	1 5	....	....	Heavy dew, clear.	Cu. Str. 2.	" 8.
12	940	917	944	56.0	77.1	63.7	.370	.422	.471	.84	.46	.81	N. W. by N.	S. W.	W.	45.80	1.5	....	....	Clear.	Clear.	" 2.
13	987	870	900	64.1	82.3	69.1	.376	.425	.496	.89	.39	.70	S. S. W.	N. by W.	W. S. W.	38.04	2 0	....	....	"	Str. 4.	Clear.
14	849	838	832	67.5	87.9	70.1	.489	.543	.482	.75	.42	.66	W. S. W.	S. W.	S. S. W.	96.10	2.0	....	....	"	Cirr. St. 4.	"
15	816	735	770	66.9	89.0	73.5	.438	.569	.525	.68	.42	.61	S. W.	S. W.	S. W.	65.60	2 0	....	....	C. C. Str. 4.	Clear.	Cu. Str. 9.
16	776	517	604	68.6	84.2	62.0	.809	.545	.586	.81	.47	.92	S. W.	W. S. W.	W. N. W.	79.50	1.5	1.880	....	Cu. Str. 4.	Cu. Str. 6.	" 9. thunder.
17	832	827	914	60.0	72.9	65.0	.338	.383	.458	.65	.48	.75	W. N. W.	W. by N.	W. by N.	125.99	3 5	....	....	Clear.	C. C. Str. 4.	Clear.
18	821	784	690	62.3	84.2	69.2	.390	.470	.503	.72	.40	.66	S. S. W.	S. S. W.	S. W.	53.20	2 0	....	....	C. C. Str. 6.	Clear.	" Aurora Borealis.
19	688	594	680	70.2	88.4	74.5	.621	.650	.497	.85	.49	.59	S. W.	W. by S.	S. S. W.	17.90	2.0	....	....	Cu. Str. 8.	C. C. Str. 8.	Cu. Str. 6. Distant Lightn'g.
20	826	809	602	64.7	81.0	68.9	.458	.510	.536	.75	.48	.77	S. S. W.	W. by S.	S. W.	78.80	2.5	....	....	Clear.	Clear.	" 4.
21	419	371	572	63.4	67.9	55.0	.536	.584	.328	.92	.87	.77	S. S. W.	W.	W. by W.	50.30	3.0	0.440	....	Rain.	C. Str. 4.	" 8.
22	748	777	676	50.9	71.4	60.3	.302	.503	.345	.82	.66	.68	W. N. W.	W. by N.	W. by N.	220.40	1.5	....	....	Clear.	Clear.	" 9.
23	421	323	652	61.0	68.6	44.9	.413	.413	.275	.77	.65	.92	S. by W.	W. by N.	W.	232.20	2 0	1.055	....	C. C. Str. 6.	Cu. Str. 6.	Clear. Aurora Borealis.
24	612	566	739	51.0	64.2	55.8	.296	.403	.365	.79	.68	.76	S. W.	S. W.	S. W.	151.70	3.0	1 250	....	Clear.	" 8.	"
25	861	624	858	51.3	78.0	02.0	.321	.614	.429	.86	.54	.77	S. W.	S. W.	S. S. W.	31.20	2.0	....	....	Fog.	" 4.	Clear.
26	508	614	703	63.1	71.3	64.0	.517	.403	.536	.91	.54	.92	S. S. E.	S. S. W.	S. S. W.	90.40	2.5	0.706	....	Cu. Str. 4.	Nim. 10.	Cu. Str. 10. thunder.
27	878	840	30.007	53.7	68.2	56.6	.223	.232	.336	.64	.34	.75	N. by W.	N. N. E.	N. by W.	125.40	1.5	....	....	Clear.	C. C. Str. 6.	" 2.
28	991	967	29.976	47.5	74.2	63.0	.291	.568	.388	.89	.67	.69	W.	S. W.	S. W.	18.30	1.0	....	....	" heavy dew.	Clear.	Clear.
29	779	665	612	65.6	70.0	59.1	.483	.483	.477	.78	.66	.95	S. S. W.	S. S. E.	S. S E.	99.90	2.0	Inapp.	....	Cu. Str. 6.	Cu. Str. 10.	Nim. 10.
30	626	601	698	64.2	80.3	62.4	.461	.599	.399	.77	.59	.72	W. S. W.	S. S. W.	W.	78.80	1.0	....	....	Clear.	" 4.	Clear.
31	701	608	744	56.6	72.1	58.3	.413	.524	.328	.90	.66	.77	S. S. W.	W. S. W.	W.	131 10	3.0	0.071	....	Cu. Str. 8.	" 10.	Cu. St. 6.

REMARKS FOR JUNE, 1860.

Barometer....... { Highest, the 24th day, 30·114 inches. Lowest, the 4th day, 29.231 " Monthly Mean, 29.682 " " Range, 0.883 "

Thermometer... { Highest, the 14th day, 91° 0. Lowest, the 12th day, 44° 8. Monthly Mean, 68° 15. Monthly Range, 46° 2.

Greatest intensity of the Sun's rays, 101° 2.
Lowest point of Terrestrial radiation, 34° 6.
Mean of Humidity, .715.
Amount of Evaporation, 3.72 inches.

Rain fell on 10 days, amounting to 2.840 inches; it was raining 18 hours and 15 minutes, and was accompanied by thunder on one day.
Most prevalent wind, the S. E. by E.
Least prevalent wind, the N.
Most windy day, the 20th day; mean miles per hour, 10.41.
Least windy day, the 19th day; mean miles per hour, Inapp.
Aurora Borealis visible on 1 night.
Solar Halo visible on 2 days.
The Electrical state of the Atmosphere indicated moderate and constant tension.
Ozone was present in moderate quantity.

REMARKS FOR JULY, 1860.

Barometer. ...... { Highest, the 27th day, 30.607 inches. Lowest, the 23rd day, 29.323 " Monthly Mean, 29.733 " Monthly Range, 0.684 "

Thermometer. { Highest, the 14th day, 89° 1. Lowest, the 22nd day, 43° 8. Monthly Mean, 65° 47. Monthly Range, 45° 3.

Greatest intensity of the Sun's rays, 100° 3.
Lowest point of terrestrial radiation, 37° 1.
Mean of humidity, .679.
Amount of Evaporation, 3·78 inches.

Rain fell on 8 days, amounting to 5.732 inches; it was raining 25 hours 15 minutes, and was accompanied by thunder on two days.
Most prevalent wind, the S. S. W.
Least prevalent wind, the N. by W.
Most windy day, the 3rd day; mean miles per hour, 15.52.
Least windy day, the 5th day; mean miles per hour 0.83.
Aurora Borealis visible on 3 nights.
Meteor in N. W. at 8.30 p. m. 21st day.
The Electrical state of the Atmosphere has indicated constant and moderate intensity.
Ozone was in moderate quantity.
Eclipse of the Sun visible on the 18 day.

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ARTICLE XLIV.—*Abridged Sketch of the Life of Mr. David Douglas, Botanist, with a few details of his travels and discoveries.*

(Continued from last Number.)

After the misfortune recorded in our last, Douglas pursued his way to Fort Vancouver by the same route by which he had come, botanizing still more sedulously than ever, in order to make up as far as possible for his recent heavy loss. In October, he left the Columbia, as it afterwards unfortunately proved, for the last time. A land where his discoveries had furnished him frequently with the brightest moments of the purest joy, and where also his losses had caused him days of the most poignant sorrow and regret. He arrived at Waohoo on the 23rd December. On the 31st he was at Hawaii, on which stand the great volcanic peaks. His account of the ascent of these is most interesting and we angle from his journal as much as our limits and the patience of readers may be supposed to render admissible.

After all preliminary preparations, and passing two days with his party drenched with rain on the skirts of Mouna Kuah, we find him on the 9th January 1834, recovering from the effects of the weather, and partaking of a young wild bull, shot by a person who had joined them. The weather on the following day

still improving, he cleared the wooded region, but night coming on quickly returned to its edge and encamped. All were on foot early on the 11th. After passing the last plants to be seen on the ascent, viz : a gigantic composite (*Argyrophyton Douglasii*) and a small *Juncus* he begins his scientific remarks.

" The great difference produced on vegetation by the agitated and volcanic state of the mountain is very distinctly marked. Here there is no line betwen the phenogamous and cryptogamous plants, but the limits of vegetation itself are defined with the greatest exactness, and the species do not gradually diminish in number and stature, as is generally the case on such high elevations."

" The line of what may be called the woody-country, at the upper verge of which the barometer expresses 21·450 inches, thermometer 46° at 2 P. M., is where we immediately enter on a region of broken and uneven ground, with here and there lumps of lava rising above the general declivity to a height of three hundred to four hundred feet, intersected by deep chasms, which shew the course of the lava when in a state of fluidity. This portion of the mountain is highly picturesque and sublime. Three kinds of timber of small growth are scattered over the low knolls, with one species of *Rubus* and *Vaccinium*, the genus *Fragaria*, and a few *Graminia*, *Filices*, and some alpine species. This region extends to bar. 20.020 in., air 40°, dew point 30°. There is a third region, which reaches to the place where we encamped yesterday, and seems to be the great rise or spring of the lava, the upper part of which at the foot of the first extinct peak is bar. 20.010 in., air 39°."

" 12th. At six o'clock, accompanied by three Islanders, and two Americans, I started for the summit of the mountains ; bar. at that hour indicated 20.000 inches, therm. 24° ; hygr. 20° ; and a keen west wind was blowing off the mountain, which was felt severely by us all, and especially by the natives, whom it was necessary to protect with additional blankets and great coats. We passed over about five miles of gentle ascent, consisting of large blocks of lava, sand, scoriæ, and ashes, of every size, shape and color, demonstrating all the gradations of calcination, from the mildest to the most intense. This may be termed the table land or platform, where spring the great rent holes of the subterranean fire or numerous volcanoes. The general appearance is that of the channel of an immense river heaved up. In some places the

round boulders of lava are so regularly placed, and the sand is so washed in around them, as to give the appearance of a causeway, while in others, the lava seems to have run like a stream. We commenced the ascent of the great peak at nine o'clock, on the N. E. side, over a ridge of tremendously rugged lava, four hundred and seventy feet high, preferring this course to the very steep ascent of the south side, which consists entirely of lava, ashes, and scoriæ, and we gained the summit soon after ten. Though exhausted with fatigue before leaving the table land, and much tried by the increasing cold, yet such was my ardent desire to reach the top, that the last portion of the way seemed the easiest. This is the loftiest of the chimneys: a lengthened ridge of two hundred and twenty one yards two feet running nearly straight N. W. To the north, four feet below the extreme summit of the peak, the barometer was instantly suspended, the cistern being exactly below, and when the mercury had acquired the temperature of the circumambient air, the following register was entered at 11 h. 20 m.; bar. 18.362 in.; air 33°; hygr. 0″ 5. At 12 o'clock the horizon displayed some snowy clouds; until this period the view was sublime to the greatest degree, but now every appearance of a mountain storm come on. The whole of the low S. E. point of the island was throughout the day covered like a vast plain of snow with clouds. The same thermometer laid on the bare lava, and exposed to the wind at an angle of 27° expressed at first 37° and afterwards at 12 o'clock 41°, though when held in the hand, exposed to the sun, it did not rise at all. It may well be conjectured that such an immense mass of heating material, combined with the influence of internal fire, and taken in connexion with the insular position of Mouna Kuah, surrounded by an immense ocean of water, will have the effect of raising the snow line considerably: except on the northern declivity, or where sheltered by large blocks of lava, there was no snow to be seen: even on the top of the cairn where the barometer was fixed, there were only a few handsful. One thing struck me as curious, the apparent non-diminution of sound, not as respects the rapidity of its transmission, which is, of course, subject to a well known law. Certain it is, that on mountains of inferior elevation, whose summits are clothed with perpetual snow and ice, we find it needful to roar into one another's ears, and the firing of a gun, at a short distance, does not disturb the timid antelope on the high snowy peaks of N. W. America. Snow is doubtless a non-con-

ductor of sound, but there may be also something in the mineral substance of Mouna Kuah which would effect this."

"Were the traveller permitted to express the emotions he feels when placed on such an astonishing part of the earth's surface, cold indeed must his heart be, to the great operations of nature, and still colder towards nature's God, by whose wisdom and power such wonderful scenes were created, if he could behold them without deep humility and reverential awe. Man feels himself as nothing, as if standing on the verge of another world. The death like stillness of the place, not an animal nor an insect to be seen, far removed from the din and bustle of the world, the whole impresses on his mind with double force, the extreme helplessness of his condition; an object of pity and compassion, he feels utterly unworthy to stand in the presence of a great and good, and wise and holy God, and to contemplate the diversified works of his hands!"

We find the description of the visit to the great crater of Mouna Roa, undertaken a few days afterwards possessed of even still greater interest, while some amusing traits of the natives are touched upon. We shall therefore draw more largely from this, the last it may be called, of the written work of the lamented Douglas.

"On the 22nd of January, the air being pleasant, and the sun occasionally visible, I had all my packages assorted by nine A. M. and engaged my old guide Honori, and nine men to accompany me to the volcano and to Mouna Roa. As usual there was a formidable display of luggage, consisting of *papas*, *calabashes*, *poe*, *tara* &c., while each individual provided himself with the solace of a staff of sugar cane, which shortens with the distance, for the pedestrian when tired and thirsty sits down and bites off an inch or two from the end of his staff. A friend accompanied me as far as his house on the road, where there is a large church, his kind intention being to give me some provision for the excursion, but as he was a stout person I soon out-stripped him. On leaving the bay, we passed through a fertile spot, consisting of paro patches in ponds, where the ground is purposely overflowed and afterwards covered with a deep layer of fern leaves to keep it damp. Here were fine groves of bread fruits, and ponds of mullet and ava-fish. The scenery is beautiful, being studded with dwellings, and better plantations of vegetables, and of *Monis papyrifera* of which there are two kinds, one much whiter than the other. The most striking feature in the vegetation consists in the tree-

fern, same smaller species of the same tribe, and a curious kind of composite, like an *Eupatorium.* At about four miles and a half from the bay, we entered the wood, through which there is a tolerably cleared path, the muddy spot being rendered passable by the stems or trunks of tree ferns, laid close together crosswise. They seemed to be the same species I had observed on the ascent to Mouna Kuah. About an hours walk brought us through the wood, and we then crossed another open plain of three miles and a half at the upper end of which, in a most beautiful situation, stand the church, and close to it, the chief's house. Some heavy showers had drenched us through; still, as soon as our friend arrived, and the needful arrangements were made, I started, and continued the ascent, over a very gently rising ground, in a southerly direction, passing through some delightful country, interspersed with low timber. At night we halted at a house, of which the owner was a very civil person, though remarkably talkative. Four old women were inmates of the same dwelling, one of whom, eighty years of age, with hair white as snow, was engaged in feeding two favorite cats with fish. My little terrier disputed the fare with them, to the no small annoyance of their mistress. A well looking young female amused me with singing, while she was engaged in the process of cooking a dog on heated stones. I also observed a handsome young man whose very strong stiff black hair was allowed to grow to a great length on the top of his head, while it was cut close over the ears, and falling down on the back of his head and neck had all the appearance of a Roman helmet."

"January the 23rd. This morning the old lady was engaged in feeding a dog with fox-like-ears, instead of her cats. She compelled the poor animal to swallow poe, by cramming it into his mouth, and what he put out at the sides, she took up and ate herself; this she did as she informed me by way of fattening the dog for food. A little while before day break my host went to the door of the lodge, and after calling over some extraordinary words which would seem to set orthography at defiance a loud grunt in response from under the thick shade of some adjoining tree ferns was followed by the appearance of a fine large black pig, which coming at his master's call was forthwith caught and killed for the use of myself and my attendants. The meet was cooked on heated stones, and three men were kindly sent to carry it to the

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* Hids Bay.

volcano, a distance of twenty-three miles, tied up in the large leaves of Banana and Ti-tree. The morning was deliciously cool and clear with a light breeze. Immediately on passing through a narrow belt of wood, where the timber was large and its trunks matted with parasitic ferns, I arrived at a tract of ground, over which there was but a scanty covering of soil above the lava, interspersed with low bushes and ferns. Here I beheld one of the grandest scenes imaginable; Mouna Roa reared his bold front, covered with snow, far above the region of verdure while Mouna Roa was similarly clothed, to the timber region on the south side, while the summit was cleared of the snow that had fallen on the nights of the 12th and two following days. The district of Hido, "Byron's Bay," which I had quitted the previous day, presented, from its great moisture, a truly lovely appearance, contrasting in a striking manner with the country where I then stood, and which extended to the sea, whose surface bore evident signs of having been repeatedly ravaged by volcanic fires. In the distance, to the south-west, the dense black cloud which overhangs the volcano, attests, amid the otherwise unsullied purity of the sky, the mighty operations at present going on in that immense laboratory. The lava, throughout the whole district, appeared to be of every colour and shape, compact, bluish and black, porous, or vesicular, heavy and light. In some places it lies in regular lines and masses, resembling narrow horizontal basaltic columns; in others, in tortuous forms, or gathered into rugged humps of small elevation; while, scattered over the whole plain, are numerous extinct, abrupt, generally circular craters, varying in height from one hundred to three hundred feet, and with about an equal diameter at their tops. At the distance of five miles from the volcano, the country is more rugged, the fissures in the ground being both larger and more numerous, and the whole tract covered with gravel and lava, &c., ejected at various periods from the crater. The steam that now arose from the cracks bespoke our near approach to the summit and at two P. M., I arrived at its northern extremity, where finding it nearly level, and observing that water was not far distant, I chose that spot for my encampment. As however the people were not likely to arrive before the evening, I took a walk round the west side, now the most active part of the volcano, and sat down there, not correctly, speaking, to enjoy, but to gaze with wonder and amazement on this terrific sight, which inspired the

beholder with a fearful pleasure. From the descriptions of former visitors, I judge that Mouna Roa must now be in a state of comparative tranquillity. A lake of liquid fire, in extent about a thirteenth part of the whole crater, was boiling with furious agitation; not constantly, however, for at one time it appeared calm and level, the numerous fiery red streaks on its surface alone attesting its state of ebullition, when again, the red hot lava would dart upwards and boil with terrific grandeur, spouting to a height which from the distance at which I stood I calculated to be from forty to seventy feet, when it would dash violently against the black ledge, and then subside again for a few moments. Close by the fire was a chimney above forty feet high, which occasionally discharges its steam, as if all the steam-engines in the world were concentrated in it. This preceded the tranquil state of the lake which is situated near the south-west or smaller end of the crater. In the centre of the great crater, a second lake of fire, of circular form, but smaller dimensions, was boiling with equal intensity: the noise was dreadful beyond all description. The people having arrived, Honori last, my tent was pitched twenty yards back from the perpendicular wall of the crater; and as there was an old hut of Ti leaves on the intermediate bank, only six feet from the extreme verge, my people soon repaired it for their own use. As the sun sunk behind the western flank of Mouna Roa, the splendour of the scene increased; but when the nearly full moon rose in a cloudless sky, and shed her silvery brightness on the fiery lake, roaring and boiling in fearful majesty, the spectacle became so commanding, that I lost a fine night for making astronomical observations by gazing on the volcano, the illumination of which was but little diminished by a thick haze that set in at midnight. On Friday, January the 24th, the air was delightfully clear and I was enabled to take the bearings of the volcano and adjoining objects with great exactness. To the north of the crater are numerous cracks and fissures in the ground, varying in size, form and depth, some long, some straight, round or twisted, from whence steam constantly issued, which in two of them is rapidly condensed, and collects in small basins or wells one of which is situated at the immediate edge of the crater, and the other four hundred and eighty yards to the north of it. The latter fifteen inches deep, and three feet in diameter, about thirteen feet north of a very large fissure, according to my thermometer, compared with that

at Greenwich and at the Royal Society, and found without error, maintains a temperature of 65°. The same instrument, suspended freely in the above mentioned fissure, ten feet from the surface, expressed, by repeated trials 158°; and an equal temperature was maintained when it was nearly level with the surface. When the Islanders visit this mountain they invariably carry on their cooking operations at this place. Some pork and a fowl that I had brought, together with taro-root and sweet potatoes, were steamed here to a nicety in twenty seven minutes, having been tied up in leaves of Banana. On the sulphur bank are many fissures which continnally exhale sulphurous vapours and form beautiful prisms, those deposited in the inside being the most delicate and varied in figure, encrusting the hollows in masses, both large and small resembling swallows' nests on the wall of a building. When severed from the rock or group they emit a crakling noise by the contraction of the parts in the process of cooling. The great thermometer placed in the holes, showed the temperature to be 195°.5′, after repeated trials, which all agreed together, the air being then 71°."

"I had furnished shoes for those persons who should descend into the crater, with me but none of them could walk when so equipped, preferring a mat sole made of tough leaves, and fastened round the heel and between the toes, which seemed indeed to answer the purpose entirely well. Accompanied by three individuals, I proceeded at one P. M., along the north side, and descended the first ledge over such rugged ground as bespoke a long state of repose, the fissures and flanks being clothed with verdure of considerable size; thence we ascended two hundred feet to the level platform that divides the great and small volcanoes."

"On the left, a perpendicular rock three hundred feet above the level, shows the extent of the volcano to have been originally much greater than it is at present. The small crater appears to have enjoyed a long period of tranquillity, for down to the very crust of the lava, particularly on the east side, there are trees of considerable size, on which I counted from sixty to one hundred and twenty four annual rings or concentric layers. The lava at the bottom flowed from a spot, nearly equidistant from the great and small craters, both uniting into a river from forty to seventy yards in breadth and which appears comparatively recent. A little south of this stream, over a dreadfully rugged bank I des-

cended the first ledge of the crater, and proceeded for three hundred yards over a level space, composed of ashes, scoriæ, and large stones that have been ejected from the mouth of the volcano. The stream formerly described is the only fluid lava here. Hence to arrive at the black ledge, is another descent of about two hundred and forty feet, more difficult to be passed than any other, and this brings the traveller to the brink of the black ledge, where a scene of all that is terrific to behold presents itself before his eyes. He sees a vast basin, recently in a state of igneous fusion, now, in cooling, broken up, somewhat in the manner of the great American lades, when the ice gives way, in some places level in large sheets, elsewhere rolled in tremendous masses, and twisted into a thousand different shapes, sometimes even being filamentose, like fine hair, but all displaying the mighty agency still existing in this immense depository of subterraneous fire. A most uncomfortable feeling is experienced when then traveller becomes aware that the lava is hollow and faithless beneath his tread. Of all sensations in nature, that produced by earthquakes or volcanic agency, is the most alarming: the strongest nerves are unstrung, and the most courageous mind feels weakened and unhinged, when exposed to either. How insignificant are the operations of man's hands, taken in their vastest extent, when compared with the magnitude of the works of God!"

"On the black ledge, the thermometer held in the hand, five feet from the ground, indicated a temperature of 89°, and when laid on the Lava, in the sun's rays, 115°, and 112° in the shade; on the bank of the burning Lake, at the south end, it rose to 124°. Over some fissures in the Lava, where the smoke was of a greyish rather than a blue tinge, the thermometer stood at 94°. I remained for upwards of two hours in the crater, suffering all the time an intense headache, with my pulse strong and irregular, and my tongue parched, together with other symptoms of fever. The intense heat and sulphurous nature of the ground had corroded my shoes so much, that they barely protected my feet from the hot lava. I ascended out of the crater at the south-west or small end, over two steep banks of scoriæ, and two ledges of rock, and returned by the west side to my tent, having thus walked quite round this mighty crater."

"Saturday, Jan. 25th. I slept soundly until 2, a.m., when, as not a speck could be seen on the horizon, and the moon was unusually bright, I rose with the intention of making some lunar

observations; but though the thermometer stood at 41°, still the keen mountain breeze affected me so much, of course mainly owing to the fatigue and heat I had suffered the day before, that I was reluctantly obliged to relinquish the attempt, and being unable to settle again to sleep, I replenished my blazing stock of fuel, and sat gazing on the roaring and agitated state of the crater, where three new fires had burst out since ten o'clock the preceding evening. Poor Honori, my guide, who is a martyr to asthma, was so much affected by their exhalations (for they were on the north bank, just below my tent) that he coughed incessantly the whole night, and complained of cold, though he was wrapt in my best blanket, besides his own tapas, and some other articles that he had borrowed from my Woakee man. The latter slept with his head towards the fire, coiled up most luxuriously, and neither cold, heat, nor the roaring of the volcano, at all disturbed his repose."

On his descent from the Volcano Mr. Douglas describes some extensive caves.

"Among the grassy undulating ground are numerous caves, some of great magnitude from forty to sixty-five feet high, and from thirty to forty feet broad, many of them of great length, like gigantic arches, and very rugged. These generally run at right angles with the dome of Mouna Roa and the sea. Some of those natural tunnels may be traced for several miles in length, with occasional holes of different sizes in the roofs, screened sometimes with an overgrowth of large trees and ferns, which renders walking highly dangerous. At other places the vaults have fallen in for the space of one hundred or even three hundred yards, an occurrence which is attributable to the violent earthquakes that sometimes visit this district. The inhabitants convert these caverns to use in various ways; employing them occasionally as permanent dwellings, but more frequently as cool retreats, where they carry on the process of making native cloth, from the bark of the mulberry tree, or where they fabricate and shelter their canoes from the violent rays of the sun."

"They are also used for goat-folds and pig-styes, and the fallen in places, where there is a greater depth of decomposed vegetable matter, are frequently planted with tobacco, Indian corn, melons, and other choice plants. At a distance of ten miles north of Kapupala, and near the edge of the path, are some fine caverns above sixty feet deep. The water dropping from the top of the

vault collected into small pools below, indicated a temperature of 50°, the air of the cave being 51°, while in the shade on the outside the thermometer stood at 82°. The interior of the moist caverns are of most beautiful appearance; not only from the singularity of their structure, but because they are delightfully fringed with ferns, mosses, and jungermanniæ, thus holding out to the Botanist a most inviting retreat from the overpowering rays of a tropical sun."

At Kapupala the traveller having apologized to the worthy chief for declining an invitation to abide in a nice dwelling prepared for him, preferring a spot retired from the disagreeables of the village, he is presented with a fowl cooked on heated stones underground, some baked tara, and sweet potatoes, together with a calabash full of delicious goat's-milk, poured through the husk of a cocoa nut, in lieu of a sieve. On the morrow of the 26th, it being Sunday, Honori, the guide, officiates as preacher. In the interval between services the school house was visited.

"I visited the school in the interval, when Honori had retired to compose his second sermon, and found the assemblage under the direction of the chief, who appears to be a good man, though far from an apt scholar; they were reading the second chapter of the Epistle to the Galatians. The females were by far the most attentive, and proved themselves the readiest learners. It is most gratifying to see far beyond what is called the pale of civilization, this proper sanctification of the Lord's day, not only consisting in a cessation from the ordinary duties, but in reading and reflecting upon the purifying and consolatory doctrines of Christianity. The women were all neatly dressed in the native fashion, except the chief's wife and some few others, who wore very clean garments of calico. The hair was either arranged in curls, or braided on the temples, and adorned with tortoise-shell combs of their own making, and chaplets of balsamic flowers, the peaflowering racemes of the maurarii tree, and feathers, &c. The men were all in the national attire, and looked tolerably well dressed, except a few of the old gentlemen."

"The schoolmaster, a litttle hump-backed man, about thirty years old, little more than three feet high, with disproportionately long legs, and having a most peculiar cast in his right eye, failed not to prompt and reprove his scholars, when necessity required, in remarkably powerful tones of voice, which, when he read, produced a trumpet-like sound, resembling the voice of a person bawling into a cask."

"Honori had the people called together, by the sound of a conch shell, blown by a little imp of a lad, perched on a block of lava in front of the school house, when, as in the morning, he "lectured" on the third chapter of St. John."

On Tuesday, the 28th January he again moves from Kapupala upwards, for a sight of the highest peak of Mouna Roa.

"Among my attendants was one singular looking personage, a stripling, who carried a small packet of instruments, and trotted away in a "cutty sark," of scanty longitude, the upper portion of which had been once of white, and the lower of red flannel. Honori brought up the rear, with a small telescope slung over his shoulder, and an umbrella, which owing perhaps to his asthmatic complaint, he never fails to carry with him, both in fair and foul weather."

"At eleven, a.m., we came to a small pool of fresh water, collected in the lava, the temperature of which was 55°; here my people halted for a few minutes to smoke. The barometer stood at 26 inches, the air 62°, and the dew point at 58°. The wind was from the south, with a gentle fanning breeze and a clear sky. Hence the path turns north-west for a mile and a half, becoming a little steeper, till it leads to a beautiful circular well, three feet deep, flowing in the lava, its banks fringed with Strawberry vines, and shaded by an Acacia Tree Grove. Here we again rested for half an hour. I would recommend to any Naturalists who may in future visit this mountain, to have their canteens filled at the well just mentioned, for my guide, trusting to one which existed in a cave further up, and which he was unable to find, declined to provide himself with this indispensable article at the lower well, and we were consequently put to the greatest inconvenience. Among the brush wood was a strong kind of raspberry bush, destitute of leaves; the fruit I am told is white. At 4 P. M. we arrived at a place where the lava suddenly became rugged, and the brushwood low, where we rested and chewed Sugar Cane, (of which we carried a large supply), and where the guides were anxious to remain all night. As this was not very desirable, since we had no water, I proceeded for an hour longer, to what might be called the line of Shrubs, and at two miles and a half further on, encamped for the night. We collected some small stems of a heath-like plant, which with the dried stalks of the same species of compositæ which I observed on Mouna Kuah, afforded a tolerably good fire. The

man who carried the provisions, did not make his appearance—indeed it is very difficult except by literally driving them before you, to make the natives keep up with an active traveller. Thus I had to sup upon Taro Roots. Honori as I expected, did not come up. I had no view of the surrounding country for the region below, especially over the land, was covered with a thick layer of fleecy mist, and the cloud which always hovers above the great volcano, overhung the horizon, and rose into the air like a great tower. Sunset gave a totally different aspect to the whole, the fleecy clouds changed their hue to a vapoury tint, and the volume of mist above the volcanoes, which is silvery bright during the prevalence of sunshine, assumed a fiery aspect, and illumined the sky for many miles around. A strong north-west mountain breeze sprung up, and the stars, especially Canopus and Sirius, shone with unusual brilliancy. Never even under a tropical sky did I behold so many stars. Sheltered by a little brushwood, I lay down on the lava beside the fire, and enjoyed a good night's rest, while my attendants, swarmed together in a small cave, which they literally converted into an oven by the immense fire they kindled in it."

"Wednesday, January 29th.—The morning rose bright and clear, but cold, from the influence of a keen mountain breeze. As the man who carried the provisions was still missing, the preparation of breakfast occupied but little time, so that accompanied by the Bird Catcher and "Cutty Sark," I started at half past six for the summit of the mountain, leaving the others to collect fuel, and to look for water. Shortly before day-break the sky was exceedingly clear and beautiful, especially that part of the horizon where the sun rose, and above which the upper rim of his Disc was visible like a thread of gold, soon to be quenched in a thick haze, which was extended over the horizon. It were difficult, nay almost impossible to describe the beauty of the sky, and the glorious scenes of this day. The lava is terrible beyond description and our track lay over ledges of the ronghest kind, in some places glassy and smooth like slag from the furnace, compact and heavy like basalt; in others tumbled into enormons mounds, or sunk in deep valleys, or rent into fissures, ridges, and clefts. This was at the verge of the snow—not twenty yards of the whole space could be called level or even. In every direction vast holes or mouths are seen, varying in size, form, and color, from ten to seventy feet high. The lava that has been vomited forth from

these openings presents a truly novel spectacle. From some, and occasionally indeed from the same mouth, the streams may be seen pressed forward transversely, or in curved segments, while other channels present a floating appearance; occasionally the circular tortuous masses resemble gigantic cables, or are drawn into cords, or even capillary threads, finer than any silken thread, and carried to a great distance by the wind. The activity of these funnels may be inferred from the quantity of slag lying round them, its size, and the distance to which it has been thrown. Walking was rendered dangerous by the multitude of fissures, many of which are but slightly covered by a thin crust, and every where our progress was exceedingly laborious and fatiguing. As we continued to ascend, the cold and fatigue disheartened the Islanders, who required all the encouragement I could give, to induce them to proceed. As I took the lead, it was needful for me to look behind me continually, for when once out of sight, they would pop themselves down, and neither rise nor answer to my call. After resting for a few minutes at the last station, I proceeded about seven miles further, over a similar kind of formation, till I came to a sort of low ridge, the top of which I gained soon after eleven P. M., the thermometer indicating 37°, and the sky very clear. This part was of gradual ascent, and its summit might be considered the southern part of the dome. The snow became very deep, and the influence of the sun melting its crust, which concealed the sharp points of the lava, was very unfavorable to my progress. From this place to the north, towards the centre of the dome, the hill is more flattened. Rested a short time, and a few minutes before noon, halted near the highest black shaggy chimney, to observe the sun's passage. In recording the following observations, I particularly note the places, in order that future visitors may be able to verify them. To the S. W. of this chimney, at the distance of one hundred and seventy yards stands a knoll of lava, about seventy feet above the gradual rise of the place. The altitude was 104°. 52′. 45″. This observation was made under highly favorable circumstances, on a horizon of Mercury without a roof, it being protected from the wind by a small oil cloth—bar. 18°. 953″. therm. 51°; in the sun's rays 43°. 5′, and where buried in the snow 31°., the dew point at 7°.!! Wind, S. W. The summit of this extraordinary mountain is so flat, that from this point no part of the Island can be seen, not even the high peaks of Mouna Kuah, nor the distant horizon of

the sea, though the sky was remarkably clear. It is a horizon of itself, and about seven miles in diameter. I ought, ere now, to have said that the Bird Catcher's knowledge of the volcanoes did not rise above the woody region, and now he and my two other followers were unable to proceed further. Leaving these three behind, and accompanied by only Calipso, I went on about two miles and a half, when the great terminal volcano or cone of Mouna Roa burst on my view: all my attempts to scale the black ledge here were ineffectual, as the fissures in the lava were so much concealed, though not protected, by the snow, that the undertaking was accompanied with great danger. Most reluctantly was I obliged to return, without being able to measure accurately its extraordinary depth. From this point I walked along upon the brink of the high ledge, along the east side, to the hump, so to speak, of the mountain, the point, which, as seen from Mouna Kuah, appears the highest. As I stood on the brink of the ledge the wind whirled up from the cavity with such furious violence, that I could scarcely keep my footing within twenty paces of it. The circumference of the black ledge of the nearly circular crater, described as nearly as my circumstances would allow me to ascertain, is six miles and a quarter. The ancient crater has an extent of about 24 miles. The depth of the ledge from the highest part (perpendicular station on the east side) by an accurate measurement with a line and plummet, is twelve hundred and seventy feet. It appears to have filled up considerably all round; that part to the north of the circle seeming to have, at no very remote period, undergone the most violent activity, not by boiling and overflowing, nor by discharging under ground, but by throwing out stones of immense size to the distance of miles around its opening, together with ashes and sand. Terrible chasms exist at the bottom, appearing, in some places, as if the mountain had been rent to its very roots; no termination can be seen to their depth, even when the eye is aided with a good glass, and the sky is clear of smoke, and the sun shining brightly. Fearful indeed must the spectacle have been, when this volcano was in a state of activity. The part to the south of the circle, where the outlet of lava has evidently been, must have enjoyed a long period of repose. Were it not for the dykes on the west end, which shew the extent of the ancient cauldron, and the direction of the lava, together with its proximity to the existing volcano, there is little to arrest the eye of the naturalist over the greater portion of

this huge dome, which is a gigantic mass of slag, scoriæ, and ashes. The barometer remained stationary during the whole period spent on the summit, nor was there any change in the temperature or in the dew point to-day. While passing, from eight to nine o'clock, over the ledges of lava of a more compact texture, with small but numerous vesicles, the temperature of the air being 36°.–37°., and the sun shining powerfully, a sweet musical sound was heard, proceeding from the cracks and small fissures, like the faint sound of musical glasses, but having at the same time a kind of hissing sound like a swarm of bees. This may perhaps be owing to some great internal fire escaping. Or is it rather attributable to the heated air on the surface of the rocks, rarified by the sun's rays? In a lower region, this sound might be overlooked, and considered to proceed by possibility, from the sweet harmony of insects, but in this high attitude it is too powerful and remarkable, not to attract attention. Though this day was more tranquil than the 12th, when I ascended Mouna Kuah, I could perceive a great difference in sound: I could not now hear half so far as I did on that day, when the wind was blowing strong. This might be, owing to this mountain being covered with snow, whereas on the 12th, Mouna Kuah was clear of it. Near the top I saw one small bird, about the size of a common sparrow, of a light grey mixed colour, with a faintly yellow beak—no other living creature met my view above the woody region. This little creature, which was perched on a block of lava, was so tame as to permit me to catch it with my hand, when I instantly restored it its liberty. I also saw a dead hawk in one of the caves. On the east side of the black ledge of the Great Terminal Crater, is a small conical funnel of scoriæ, the only vent-hole of that substance, that I observed in the Crater. This mountain appears to be differently formed from Mouna Kuah, it seems to be an endless number of layers of lava, from different overflowings of the great crater. In the deep caves at Kapupala, two thousand feet above the level of the sea, the several strata are well defined, and may be accurately traced, varying in thickness with the intensity of the action, and of the discharge that has taken place. Between many of these strata are layers of earth, containing vegetable substances, some from two feet to two feet seven inches in thickness, which bespeak a long state of repose between the periods of activity in the volcano. It is worthy of notice, that the thickest strata are

generally the lowest, and they become thinner towards the surface. In some places I counted twenty-seven of these layers, horizontal, and preserving the declination of the mountain. In the caves which I explored near my camp, which are from forty to seventy feet deep, thin strata of earth intervene between successive beds of lava, but none is found nearer the surface than thirteen layers. No trace of animal, shell, or fish, could I detect in any of the caverns or caves, either in this mountain or Mouna Kuah. At four P. M. I returned to the centre of the dome, where I found the three men whom I have left, all huddling together to keep themselves warm. After collecting a few specimens of lava, no time was to be lost in quitting this dreary and terrific scene. The descent was even more fatiguing, dangerous, and distressing than the ascent had proved, and required great caution to escape unhurt: for the natives benumbed with cold, could not walk fast. Darkness came on all too quickly, and though the twilight is of considerable duration, I was obliged to halt, as I feared, for the night, in a small cave. Here though sheltered from the N. W. breeze, which set in more and more strongly, as the sun sunk below the horizon, the thermometer fell to 19°, and I was yet far above the line of vegetation, unable to obtain any materials for fire, and destitute of clothing, except the thin garments soaked in perspiration, in which I had travelled all day, and which rendered the cold most intense to my feelings. I ventured, between ten and eleven P. M. to make an effort to proceed to the camp. Never shall I forget the joy I felt when the welcome moon, for whose appearance I had long been watching, first shewed herself above the volcano. The singular form which this luminary presented, was most striking. The darkened limb was uppermost, and as I was sitting in darkness, eagerly looking for her appearance on the horizon, I descried a narrow silvery belt 4° to 5° high, emerging from the lurid fiery cloud of the volcano. This I conceived to be a portion of the light from the fire, but a few moments shewed me the lovely moon shining in splendour in a cloudless sky, and casting a guiding beam over my rugged path. Her pale face actually threw a glow of warmth into my whole frame, and I joyfully and thankfully rose to scramble over the rough way, in the solitude of the night, rather than await the approach of day in this comfortless place. Not so thought my followers. The bird-catcher and his two companions would not stir; so with my trusty man Calipso, who follows me like a

shadow, I proceeded in the descent. Of necessity we walked slowly, stepping cautiously from ledge to ledge, but still having exercise enough to excite a genial heat. The splendid constellation of Orion, which had so often attracted my admiring gaze in my own native land, and which had shortly passed the meridian was my guide. I continued in a south-east direction till two o'clock, when all at once I came to a low place, full of stunted shrubs. Of more robust habit, however than those at the camp, I instantly struck a light and found by an examination of my barometer, that I was nearly five hundred feet below the camp. No response was given to our repeated calls. It was evident that no human being was near, so by the help of the moon's light we shortly collected plenty of fuel, and kindled a fine fire. No sooner did its light and warmth begin to diffuse themselves over my frame, than I found myself instantly seized with violent pain and inflammation in my eyes, which had been rather painful on the mountain, from the effect of the sun's rays shining on the snow; a slight discharge of blood from both eyes followed, which gave me some relief, and which proved that the attack was as much attributable to violent fatigue as any other cause. Having tasted neither food nor water since an early hour in the morning, I suffered severely with thirst; still I slept for a few hours, dreaming the while of gurgling cascades, overhung with sparkling rainbows, of which the dewy spray moistened my whole body, while my lips were all the time glued together with thirst, and my parched tongue almost rattled in my mouth. My poor man Calipso was also attacked with inflammation in his eyes, and gladly did we hail the approach of day."

"The sum rose brightly on the morning of Thursday, January 30th, and gilding the snow over which we had passed, showed our way to have been infinitely more rugged and precarious, than it had appeared by moonlight. I discovered that by keeping a mile and a half too much to the east, we had left the camp nearly five hundred feet above our present situation; and returning thither over the rocks, we found Honori engaged in preparing breakfast. He had himself reached the camp about noon on the second day. He gave me a calabash full of water, with a large piece of ice in it, which refreshed me greatly. A few drops of Laudanum in the eyes afforded instant relief both to Calipso and myself. The man with provision was here also, so we shortly made a comfortable meal, and immediately after, leaving one man

behind with some food for the bird-catcher, and his two companions, we prepared to descend, and started at nine A. M. to retrace the path by which we had come. Gratified though one may be at witnessing the wonderful woks of God, such a pricalen as the summit of this mountain presents, still it is with thankfulness that we again approach a climate more congenial to our natures, and welcome the habitations of our fellow men, where we are refreshed with the scent of vegetation, and soothed by the melody of birds. When about three miles below the camp, my three companions of yesterday appeared like mawkins on the craggy lava, just at the very spot where I had come down. A signal was made them to proceed to the camp, which was seen and obeyed, and we proceeded onwards, collecting a good many plants by the way. Arriving at Strawberry Well, we made a short halt to dine, and ascertained the barometer to be 25° 750′; air 57°; and the well 51°; dew 56°. There were vapouring light clouds in the sky and a S. W. wind. We arrived at Kapupala at 4 P.M. The three other men came up at seven, much fatigued, like myself. Barometer at Kapupala at 8 P. M. 27° 936′, air 57° and the sky clear."

Thus was described for the first time Mouna Roa, within whose summit and flanks is contained one of the outlets of earth's interior fires,—an opening to that awful laboratory, of whose operations we may have a slight glimpse, standing fearfully at a distance, while our comprehension quails at the attempt to investigate their causes or origin. In the crater of Mouna Roa, are the deep caverns, the profound unfathomable abysses, the ceaseless flow of fiery molten matter, which sometimes glides like a rapid stream into these abysses, till it is lost to the view, and in other places surges and boils up into swelling lofty jets, as if impatient of being pent in by those walls of lava, scoriæ, and ashes, which itself in its own former fury had formed. How vastly deep, expanded, and powerful must be the interior movement that produces all this! Well has it been surmised that the dreadful earthquake originates in the same agency. Were the plastic fluid masses of the active volcano solidified, and crusted over, we should then have the hollow rumbling and onward wave of the earthquake, overturning men's habitations like anthills, and no exit being permitted, the solid granite would be upheaved, and the foundations of the mountains laid.

Mr. Douglas continued on these Islands botanizing, and was at

Woahoo in May, from which place he communicated with his friends in England; having returned to Hawaii, he was again out on the south side of Mouna Roa, on the 12th July, 1834, on the road to Hido. Here he was cautioned to avoid the pits, dug purposely by the natives, for the taking of wild cattle. Notwithstanding this friendly warning, it appears he was not sufficiently on his guard. Some islanders, on the same day, in pursuit of cattle, perceived one of these pits broken, and on looking in, saw Mr. Douglas' body at the bottom, with a bullock standing over it. Assistance being soon had, the animal was shot, and the ill-fated and amiable naturalist taken out without a sign of life. He had been miserably bruised and gored to death. There had been three pits at this spot, close to some water, two upon the line of the path, and another to one side. On examination, it appeared as if the unfortunate traveller had looked at the two on the road, in one of which was a cow; that he had afterwards proceeded about thirty paces, and then leaving his bundle and little dog, had turned back to the third pit, in which there happened to be another animal. He must have approached this too incautiously, and either by the earth giving way, or by a false step have fallen in, and came into the power of the enraged beast. Amid those scenes which he loved so well, but far from human help, so perished one devoted to science, and who in a few years, and with slender means had accomplished much in her cause. He had been successful to a high degree in gratifying the lovers of botany by his discoveries, and in adding to the pleasures of those tender hearts who delight in the floral riches of the garden. His contributions had been not so much of a kind to increase largely the number of hot house plants, but rather of those that with a little early warmth and protection, will flourish out of doors in a temperate climate. On this account, therefore, he may be considered to have contributed more abundantly to the amount of amusement and to the benefits of social life. He added to the enjoyment of all those who can afford to have a patch of soil, however small, around their humble dwellings. In this manner has been encouraged the pursuit of a gentle art, the study of which softens the heart and improves the mind, or in the beautiful words of the poet, "Emollit mores, nec sinit esse feros."

The remains of the deceased were conveyed to Woahoo, on the 3rd August, examined by a medical gentleman, and next day

consigned to the narrow house, the grave, in the presence of Richard Charlton, Esq., British Consul, Captain Seymour, and officers of the Challenger, and all the foreign residents at the place. Lament may be allowed for David Douglas. Through eleven years of toil and hardship, danger, difficulty, and loss, he had strenuously worked his way, following his vocation with a devoted spirit and undaunted courage. He feared God, was beloved by his friends, and esteemed by all who ever had the happiness of knowing him. An inscrutable decree cut him down as he grasped the laurel of wordly fame. Fleeting though that may often be, still the noble qualities of his soul hold fresh impressions on the memory of his friends, and his worth as a useful member of society, and practical botanist, will live and be felt while the study and cultivation of plants and flowers remain pleasing and beneficial to mankind. G. B.

ARTICLE XLV.—*A Holiday Visit to the Acton Copper Mines.* By one of the Editors.

Before entering upon the special subject of this paper, we shall explain to our readers in what place within the Province of Canada these mines may be found. If, then, we start from the terminus of the Grand Trunk Railway at Montreal, and crossing the far-famed Victoria Bridge take the road towards Portland, we get upon the highway to the village of Acton. Travelling thus in a direction a little north of east we pass over the beautiful plains of the county of Chambly and the still more lovely valley of the Yamaska, which, were they cultivated with any degree of skill, or intelligence, would rival for productiveness the prairies of the west, and yield immense wealth to their owners and the country. As it is, the fields are for the most part miserably neglected—the soil is apparently wrought-out and impoverished by frequent cropping—the grain crops are very scanty, and the herbage of the pasture lands is little more than stunted Canada thistles. Lean men and lean kine pick up a poor subsistence on these wasted meadows of this fine county. So thoroughly has the land been cleared that bush or tree of any kind is scarcely to be seen, and even fences are few and far between. The old timber has long ago been swept away, root and branch; and the idea of planting trees for shelter, beauty or fuel, has not yet entered the rustic minds of the happy *habitans*. As we near the river Yamaska,

the scenery becomes certainly more picturesque. Clumps of wood and fertile fields relieve the eyes, and to the right the Belœil Mountain rises in front almost sheer out of the plain. Its abrupt and sloping sides are at this season luxuriantly clothed with softest verdure. This great intrusive mass of trappean rock is an object of striking beauty and one of the choicest retreats for the lovers of Nature. Its geological structure and character indicate without mistake the peculiar disturbances to which this region of country was subjected during the ancient Silurian period. Obtruded into the stratified deposits of the locality in a pasty, if not also in a molten state, and assuming a crystalline character, it has withstood for ages—an everlasting mountain—the destructive forces to the action of which it has been exposed. The bluff and rugged appearance of its north-eastern side and its gradual slope to the south-west indicate that during the tertiary age it was washed by the waters of the northern ocean. As the land gradually rose from the bed of the deep it stood as one of a group of small islands amid a waste of waters bearing on their bosom flows, and bergs of ice. But many a change has passed over the earth's surface since these very ancient days. For ages Belœil has stood as it now appears an outpost sentinel of the Mountains of Vermont. It has long looked over the fertile valley of the St. Lawrence. It has been the abode of the wolf, the bear and concolor, and the camping ground of the wild Indian. Civilization has for half a century at least driven these away from its precincts and it is now a pleasant resort of the summer tourist. For the botanist no place can be more delightful or richer of results. Its flora comprises a great part of the plants that are peculiar to the northern United States and to Canada. Were it our purpose now to descant upon this inviting topic we might say much that would be interesting but we must pass on, however reluctantly, to our appointed destination. Leaving Belœil we sight, in the distance to the west, the conical peak of Mount Johnston and the huge whale-like elevation of Rougemont. Around us the land is dry and barren. Farms and clearances are not so common. Tangled bush and mossy swamp everywhere prevail. We pass the flourishing town of St. Hyacinthe and traverse a country which for many miles has no features of interest, and little to indicate that it can be of much value for permanent settlement. About seventy miles from Montreal we finally reach the village of Acton, a station on the line of railway. Once it was a poor and

little frequented place, but now, thanks to the copper mines, it is full of vigorous life. There is no beauty about it at all. The country around it has not to any great extent been cleared. Patches of cultivated and pasture land here and there nestle in the woods. Stumps and scrubby bush are on all sides conspicuous features. The soil is not good; for the most part it is barren sand and scarcely worth the labour of cultivation. In some seasons it will afford good pasturage for which purpose it is most likely to be henceforth devoted.

The old houses of the hamlet are rapidly being put out of countenance by new and more pretentious erections. Large buildings are springing up on every side for stores, work-shops and dwelling-houses. Already wealth is beginning to flow into this hitherto obscure and neglected place. Its population within the last few months must have increased seven-fold at least. Signs of prosperity are everywhere manifest. The barren fields which formerly might have been purchased for an old song, are now transformed into town-building lots, and rising enormously in value. According to the course of things in this country the village bids fair to become, ere long, a town and the town, in due course, to be raised to the rank of an incorporated city.

The mines are about half a mile distant to the west from the village. The road at first passes over low and swampy ground, part of which has been cleared. A little way on the road becomes dry and sandy. About half way there is a considerable ridge of sand which lies in a direction to the west of south. Hemlock is the prevailing timber; sphagnum abounds in the swamps, in which also there is an undergrowth of curious shrubs and plants. The region is by no means picturesque but rather the very reverse. A lover of beautiful scenery would never think of seeking it here. A botanist would scarcely think the labour of forcing his way through swamps, charred stumps, fallen rotten timber, and prickly branches, repaid even by the pretty and interesting plants he would pick up. With compass in hand we attempted to explore the surrounding waste, and, except for the novelty of the thing, it was rather weary work. We satisfied ourselves of this, however, that the mound of sand runs through the bush in a line parallel to the limestone rocky ridge, about half a mile to the west, on the flank of which the mines are found, and may have been formed, in the process of the elevation of the continent, on the shores of an ancient estuary.

To a geologist this region is, however, very inviting. The traces of copper which the surface affords are sufficient stimulants to invite elaborate research. The elevations of the strata with their curious contortions are themselves interesting. The prospect of finding a fossil among such altered rock-masses by which the position of the formation in the great Silurian series might with accuracy be determined, would of itself be an inducement for the expenditure of much time and labour. As we approach the mines we are reminded by the traffic of vehicles laden with kegs heavy with precious ore that we are in the precincts of a place of unusual industry. The sound of the hammer too rings pleasantly upon the ear, and the deep hollow noise of constant blasts awaken interest in the scene. As we reach the termination of the road between the village and the mines a sight of much interest opens up to our view. An open space of about a mile in length and a quarter of a mile in breadth, entirely cleared of timber, lies before us. It is covered with temporary wooden buildings and heaps of broken rocks. Along its whole length it is cut up by trenches and shafts and deep quarries. In the back ground there rises a ridge of rock to the height of about 100 feet strewn with broken masses of stones and crowned with a scanty growth of bush.

But instead of describing these mines any further ourselves, we shall take advantage of an exceedingly lucid and succint account of the locality contained in the "Report of the Geological Survey of Canada for 1858." We had the pleasure of tracing for ourselves the topographical descriptions which it contains and verifying their remarkable accuracy.

"The existence of the copper ore on the thirty-second lot of the third range of Acton was I believe discovered by Mr. H. P. Merrill, and at the request of Mr. Cushing, the proprietor of the land, Mr. Hunt visited the locality in August last. As then seen, before any excavation had been made, the surface presented an accumulation of blocks of copper ore, evidently in place, and covering an area of about sixteen paces in length by ten paces in width. These masses consisted of variegated sulphuret of copper, intermingled with limestone and a silicious matter, without any thing like vein-stone, and evidently constituted a bed subordinate to the limestone, whose strike was about N. E., with a dip to the north-west at an angle of about forty degrees. In continuation of this bed for about seventy paces in either

direction, the limestone was observed to hold little patches and seams of variegated ore and yellow pyrites, with stains of the blue or green carbonates of copper. The limestones in the immediate vicinity presented several veins of quartz crossing the strike, but containing only traces of copper.

"During Mr. Hunt's visit, a small amount of excavation was made with pick and shovel, and a farther extent of work has been done since, but though this has not added materially to the information at first obtained, there can be no doubt, even should the limits of the deposit extend no farther than those above indicated, that there is here an unusually rich bunch of copper ore.

"The mine is just half a mile to the south of the Acton station of the Grand Trunk Railway. The road to it is over a marshy piece of ground, and it is crossed by one or two low mounds of yellow sand. At the end of the road, a hill rises to the height of about 105 feet above the marsh, and descends to a marsh on the other side. It stands on a base of a quarter of a mile in width and for nearly one-half the distance is composed of a sub-crystalline magnesian limestone dipping to the N. W. with an inclination varying from thirty to forty degrees. The limestone is light grey in fresh fractures, and weathers to a dull pale yellowish tint on the exterior. It is in some parts studded with concretionary nodules consisting of concentric layers of carbonate of lime with a transverse fibrous structure. The exterior of these is of a botryoidal form, and the layers are in some places partly replaced by chert preserving the fibrous structure. These nodules very much resemble some concretionary forms of travertine, and the occasional intercalation of magnesian layers in the nodules makes it probable they are the latter. As stated by Mr. Hunt the limestone of the hill is intersected by several small veins of quartz, and one of them, more conspicuous than the rest, carries traces of the yellow sulphuret of copper and of galena. The mass of limestone visible, extending a short distance beyond the summit of the hill, has a thickness of about 270 feet. It is divided into heavy beds in which irregular masses of chert are disseminated in unequal quantities in different places, being most abundant towards the bottom.

"The summit of the limestone from the north-eastern corner of the lot proceeds south-westward for about thirty chains, and in the succeeding 300 yards turns gradually south and ultimately a

little to the east of south before becoming concealed. In the other direction, after running some distance, it sinks beneath a marsh on the thirty-first lot of the third range, and again makes its appearance on the rail road, which it crosses about three quarters of a mile to the east of the Acton station, meeting and crossing the Black River about 220 yards north of it.

"The rock underlying the limestone is concealed, but that which immediately overlies it at the mine, appears from partial exposures to be a lavender-grey shale or slate with a cleavage independent of the bedding. In this slate there appear to be irregularly distributed large masses of a harder rock, which is internally of a light olive-green, uniformly and finally speckled with darker green spots looking like serpentine, many of which are surrounded with a bluish-grey film. The rock under atmospheric influences becomes light yellowish-brown on the surface, and in its weathering strongly resembles some of the serpentines of the Eastern Townships. Some of the masses measure fifty yards in length by twenty in breadth, on the north side of the rail road there is one of twice those dimensions, apparently sunk into the top of the limestone. Thin layers of the rock occasionally appear to be interstratified evenly among the slates. In thick masses spots of calc spar are sometimes disseminated, giving the rock a cellular and somewhat trappean aspect, but there is no evidence that it is intrusive and it occasionally assumes the character of a sandstone with small quartz pebbles running in the direction of the beds. In the speckled part of the rock very thin partitions of the same colour and hardness as the darker green spots run in several directions. These partitions on analysis prove to be a ferruginous chlorite, and the whole rock may be described as a hydrous silicate of alumina with much iron and magnesia.

"These slates and harder masses have a thickness of about eighty-five feet. They are succeeded by isolated masses of limestone of various sizes and somewhat rounded or lenticular forms, some of them attaining magnitudes of thirty yards in length by by twenty in breadth, and even eighty yards in length by ten in breadth. As seen on the surface they present a succession of protruding lumps, which run in a line parallel with the summit of the limestone, turning with it to the southward at the south-western part of the exposures. These calcareous masses consist of grey limestone made up of irregular and apparently broken beds and rounded forms, and bold irregular ragged pieces of chert in

more or less abundance, with strings and spots of calc spar. The serpentine-like rock sometimes appears to surround these calcareous masses.

"The copper ore appears to occupy a position immediately near the isolated masses of limestone, and very little of it to penetrate into the serpentine-like rock or the slate. Indications of it occur on both sides of the calcareous masses and in some places can be traced as if surrounding them; but the chief part appears to be beneath them and intermediate between them and the slates and serpentine-like rock. The ore consists of the pyritous, variegated and vitreous sulphurets of copper, the second species being the most abundant and the third more abundant than the first. The green carbonate also occurs, but it must be regarded as a secondary product formed at the surface and in cracks. The chief excavation has been made in a cross-cut running S. 45 E., which is at right angles to the strike. The depth excavated is from four to eight feet, and the following is the succession of masses met with in the cross-cut, given in a descending order and reduced to vertical thickness for horizontal measurement.

	Feet.
1. Limestone; this may be a boulder deeply sunk in the soil but it is supposed to be in place and to belong to one of the isolated masses of the stratification.........	3
Concealed......................................	3
Limestone in place, belonging to one of the isolated masses; small irregular spots of the pyritous sulphuret of copper occur in the rock; this is probably part of the same mass as the first three feet and the concealed three feet would also be a part, making the whole 8 feet....	2
2. Variegated sulphuret of copper enclosing numerous angular fragments of limestone in irregular aggregations; this mass dipped with the stratification, but thinned out and terminated downwards..........................	2
3. Limestone broken in various sized angular fragments by a number of reticulating cracks of from one quarter of an inch to three inches in width, and filled with variegated sulphuret of copper, with spots of white crystalline calc spar and occasional crystals of transparent quartz.....	15
4. Breccia or conglomerate with a paste composed of variegated and vitrious sulphurets of copper mingled with fine grained silicious matter, enclosing fragments of lime-	

stone, some angular and some rounded; some of them almost wholly calcareous and others largely silicious. The sulphurets of copper run in parallel clouded streaks, the clouded character being occasioned by the presence of more or less silicious matter mingled with the steel-grey and the purple of the two sulphurets...........	4
5. Limestone..................................	2
6. Copper breccia or conglomerate of the same characters as before..................................	4
7. Limestone..................................	3
8. Slate with traces of copper (green carbonate on the surface).................................	12
9. Serpentine-like rock.............................	14
10. Slate with traces of copper (green carbonate on the surface).................................	4
11. Concealed to the limestone......................	25
	93 ft.

"The thickness of fifteen feet given to the brecciated limestone of No. 3 is deduced from a horizontal measurement of ten yards across the strike and a supposed slope of thirty degrees, which is about the dip of the bed and of the strata where it can be made out in the vicinity. But no clear indication of bedding is visible in the body of the breccia, and as the excavation across it is yet only two feet deep, it may hereafter be proved that by some irregularity the slope is less than thirty degrees; in that case the thickness would have been reduced in proportion to the diminution of the slope. If the slope should be eighteen degrees the thickness will be ten feet.

"The two breccia or conglomerate beds numbered 4 and 6 contain the great body of the copper ore. On the strike these beds are exposed for about eight yards to the south-west. There is then an interruption by the presence of a wall of the serpentine-like rock, which crosses the strike in the shape of a slender wedge coming to a point north-westwardly and gradually spreading out into the strata in an opposite direction. A farther quantity of copper conglomerate, however, exists on the opposite side of the wedge shaped wall. The condition of the rock to the north-east of the cross-cut has not yet been sufficiently ascertained to give any description of it except from an excavation at the distance of about forty-five yards. Here a mass of ore has been mined for

about two fathoms on the strike, commencing with a breadth of nine feet, and irregularly diminishing to the north-westward. Beyond the excavation it appears to diminish farther and probably thin out. On the northwest side this mass was limited by limestone belonging to the line of isolated masses and on the south-east by a mass of serpentine-like rock, the face of which stands in a nearly vertical attitude.

"In costeening pits, which have been carried across the strike of the upper part of the ore, at distances of about eighty yards on one side of the cross-cut and 110 yards on the other, indications of ore continue to exist in the stains of green carbonate and small masses of the sulphurets, but the work done is not sufficient to give facts that bear upon the mode on which the ore is connected with the rock.

"In so far as the facts ascertained by the present condition of the excavation enable an opinion to be formed, it appears to me probable that the copper ore mingled with silicious matter constitutes the paste of a breccia or conglomerate, the fragments of which have been accumulated in a depression in the surface of the argillaceous and silico-magnesian sediments forming the slates and their associated harder masses, while the sulphurets of copper have been deposited from springs bringing the metal in solution from some more ancient formation. The whole conditions of the case appear to bear a striking resemblance to those of the copper deposits of the Urals as described by Sir Roderick Murchison, except that in Russia the ores are carbonates instead of sulphurets.

"However this may be, there is no doubt the mass of ore is a very important one ; already, after but nine weeks' work, not far from three hundred tons have been housed, supposed to contain about thirty per cent. of pure metal. The value of this quantity would be about $45,000, while exclusive of lordship, the mining expenses, and those necessary to carry the ore to a market, will be comparatively small. The quantity of ore excavated appears to have produced but a moderate impression on the total mass in sight.

"Whether such another bunch of copper ore will be met with associated with the limestone it is impossible to say : but even should one exist, it would perhaps be too much to expect that it would be found immediately at the surface.

"Many of the facts connected with the mode in which the

copper ore of the conglomerate is related to the fragments, were ascertained by slitting a slab of the rock by means of a lapidary's wheel and polishing the surface. The same test has been applied to a block of the Upton conglomerate, and it is found there is some analogy in the two cases, except that the Upton ore is altogether pyritous sulphuret and much more thinly distributed among the fragments. While large blocks of the Acton conglomerate give thirty per cent. and upwards, of pure metal, the best blocks obtained by me from the conglomerate of Upton do not yield more than five per cent. But this if the quantity of rock with such a per centage were larger and the masses not too widely scattered, would constitute a valuable mine. It would, however, require a careful crop trial to determine whether the quantity is available."

Since these observations have been made by Sir William Logan, the cupriferous deposits have been much more exposed, and their character more distinctly marked. In order to bring the matter fully before our readers we would further avail ourselves of certain geological notes which we found in the hands of the proprietors of the mines, and which we are kindly permitted to use, the descriptions and conclusions of which, after careful inspection of the ground, we are disposed to accept.

1. *Appearances of Mr. Sleeper's Openings.*

Eastern Opening.—Beds dip N. 40° W. about 50°, and consist of nodular limestone alternating with shale and overlaid by it. Copper Pyrites in small, apparently not workable, quantity, occur in both rocks, especially at their junction. The shale is much tinged with carbonate of copper. Underlying the limestone is a hard gray, irregularly bedded, earthy rock (? a volcanic ash or tufa). This rock I regard as allied to *Palagonite tuff*, and for convenience shall call it simply tufa or tufaceous rock. The section at this place is nearly as follows: (Fig. 1).

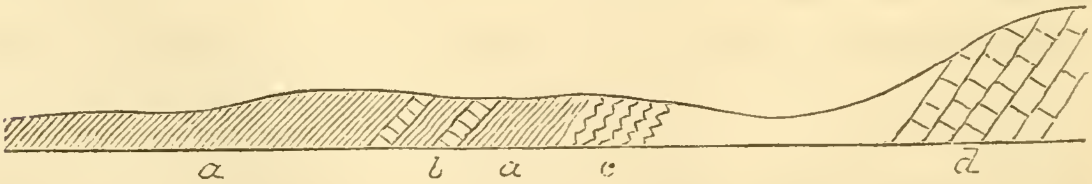

Fig. 1.

(*a*) Shale. (*b*) Copper Limestone. (*c*) Tufaceous rock. (*d*) Limestone of the hill or ridge south of the Mine.

Second Opening (Fig. 2).—This is connected with the former by a trench in the strike, showing shale with copper stains.

Beginning at the great hill limestone, we have 22 paces without section, then 27 paces shale and tufa, the latter predominating in the upper part, then 4 yards limestone, nearly vertical, then shale extending about 30 paces. At the junction of the limestone and upper shale are traces of copper pyrites, and black oxide of copper. Section as follows:—the letters referring to the same rocks as in Fig. I.

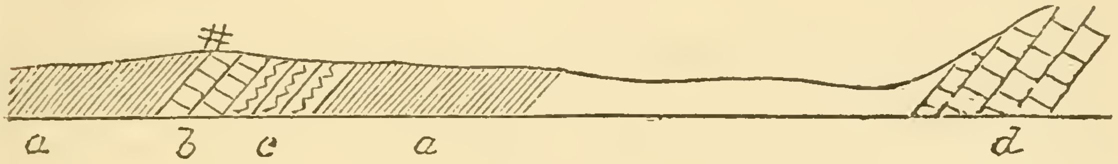

Fig. 2.

Third Opening (*Sleeper's latest*).—At this place there is a great thickness of vertical and contorted shale, apparently underlaid by tufa. The copper limestone is represented by a layer of highly cupriferous material about one foot thick at the outcrop. This was only imperfectly exposed: (Fig. 3). The ore here is purple copper.

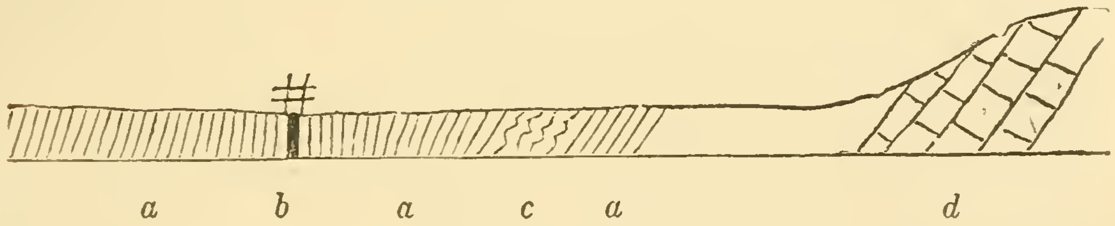

Fig. 3.

Fourth Opening (*Sleeper's shaft pit*).—At this place the copper limestone is highly developed, and presents an upper bed about 5 feet thick, holding yellow pyrites and rapidly thinning out toward the dip, a lower layer about 4 feet, very rich in purple copper in laminæ parallel to the bedding, and below this unproductive limestone and shale, which last also overlies the upper limestone. The whole of these beds are thrown into a sharp anticlinal fold. The shaft has been sunk on the part dipping toward the hill, say S. E., and the main pit exposes the crown of the arch and its N. W. side. At the corner of the fold is a fissure or vein running S. 20° W., underlying to the N. W., and containing calc spar and quartz with yellow pyrites. The valuable portion of the ore is, however, the 4 feet bed of cupriferous limestone. This does not appear to run out so far as yet followed to the dip, but disappears suddenly when followed to the east, where either a change in the original deposition or a dislocation brings in a mass of the

tufaceous rock and shale, intervening between this and the last mentioned opening: (Fig. 4.)

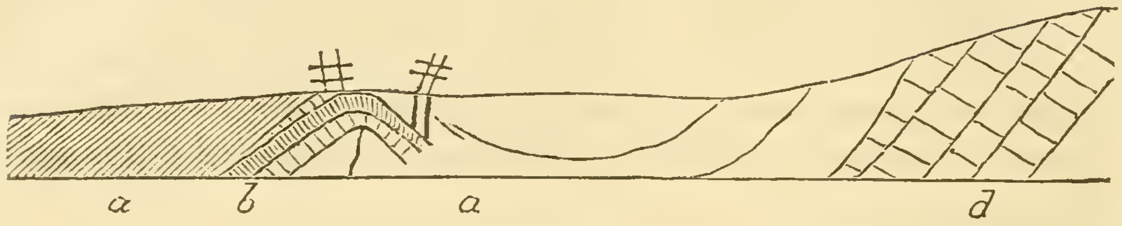

Fig. 4.

Fifth Opening (*Sleeper's original pit*).—Here the arrangement has been similar to that at the last opening, but the crown of the arch of copper limestone, now worked away, has been broader and at the surface. There is also evidence here of transverse dislocations bringing narrow belts of tufa and shale across the limestone. As in the last mentioned place the copper limestone still continues productive toward the dip.

Sixth Opening—Here the lower and unproductive part of the copper limestone is exposed. It seems largely developed, but the upper cupriferous portion has either not been deposited or has been removed by denudation. It should be sought toward the dip, and as the stratification seems arched here as at the last mentioned places, it may be found on either side.

Otte's shaft is sunk on the shale underlying the copper limestone, and which is here nearly vertical, so that it cannot reach the deposits above referred to. Near the shaft, and to the rise of the beds, there appears a cupriferous bed which deserves exploration, more especially as it is evidently not the same with that exposed in the other workings.

2. *Western Extension of the Bed.*

The copper limestone extends for some distance to the westward, its outcrop bending to the southward. In several places it contains traces of copper ores, and should be opened by trenches as at Sleeper's pits.

3. *Eastern Extension.*

No opening occurs in the beds eastward of the first above mentioned; but Mr. Sleeper reports good indications in the low land to the east, and at the railway cutting still farther east the copper limestone and tufa appear but are not known to be productive. Benjamin's opening is off the line of strike, on the Hill limestone and shows nothing of value. This is also the case with Wright's

opening, which is on the escarpment of the hill limestone, there bending so as to dip nearly north.

4. *Theory of the Deposit.*

This may be stated as follows. Water holding sulphate of copper in solution has been diffused, probably by submarine springs, through calcareous sediment, possibly containing organic matter, and the salt of copper being deoxidised has been deposited in the beds as sulphuret of the metal. The limestone itself holding this deposit is an irregular nodular bed, the "copper limestone," of the above description subordinate to the thick shale overlying the great limestone of the Acton ridge. After deposition molecular action has led to the formation of nodules and segregative veins of the copper ore, and at a later period the beds have been contorted and faulted, and in the fissures thus formed true veins, holding copper pyrites in a matrix of calc spar and quartz, have been deposited."

In regard the exposures at Upton it may be remarked that they seem to be the equivalent of the Acton Hill limestone, and show numerous veins holding yellow pyrites, and in some places galena, with calc spar and quartz. Some of these veins run parallel to the strike, which is N. E. and S. W., the dip being S. E., but there is another set nearly at right angles to it. The true equivalent of the Acton copper limestone may be found running parallel to the great limestone at some little distance.

Since the above notes were written considerable progress has been made in the work of excavation and there is still no apparent diminution of the cupriferous rock—it does not appear to thin out as it penetrates the strata in which it is embedded. That it occurs in masses of irregular thickness along the strike of the underlying limestone and thus has the character of nodular matter rather than of a regular aqueous deposit is obvious. It is not improbable that at the period of the infiltration of the copper, disturbances and alteration of the associated strata took place to a considerable extent, reducing them into their present abnormal state. It is only therefore by actual experiment that the real character of this cupriferous deposit can be ascertained. It may underlie in workable quantities, the whole of the space within the synclinal of Acton and Upton and thus prove to be one of the most extensive and valuable copper regions in the world.

But it may only be found in detached pockets of greater or less extent, and irregularly distributed throughout the valley; even in this case it will be of great value and amply repay for many years to come skilful and judicious labour.

The proprietors are about to open shafts and to erect suitable machinery for working them to the north of the present mines. These operations will determine in some measure the extent and character of the deposits. Before another year closes we may therefore hope to present to our readers a more definite account of the geological character of the Acton mines. It is evident that they are in the hands of enterprising men and are being worked with intelligence and vigour. At present they present a busy scene of active life. About 200 men, women and boys, are engaged at good wages in the various departments of the works. The strong men are busy boring and blasting and carrying off the precious fragments from the mines. Others are breaking the masses of rock into small pieces, and then a multitude of boys and girls are washing, picking, and arranging the pieces according to the quantity of copper they contain. Other workmen fill the barrels with the broken washed and selected ore; and from the mines to the Railway station at the village, there is a constant traffic of Canadian carts laden with the metallic spoils.

Several thousand tons have by this time been shipped to the market at Boston. The assay of the best quality of the ore gives from 25 to 30 per cent. of copper. This is a large percentage and must prove highly remunerative to the fortunate owners. When the requisite machinery is erected for mining, crushing, washing and smelting the rock, much that cannot now be removed from the locality on account of the cost of transit to Boston will yield a workable profit, and the copper of the richest ores will become more immediately available. The quality of the Acton copper is already coming into notice and is reckoned only second to that of Lake Superior.

By the enterprise of a few intelligent men, there has thus during the past year been opened up to Canada a source of industry and wealth that will not only benefit the parties immediately concerned but also the country at large. Whatever of value we can extract from the earth is a real addition to our wealth, increases our available means for the employment of human labour, and for the extension of our agriculture and commerce. The discovery of the Acton mines will, we doubt not, become an important epoch in the history of our national industry. A. F. K.

ARTICLE XLVI.—*Notes on the Earthquake of October*, 1860. Read before the Natural History Society of Montreal, Oct. 29, 1860.

On the 17th October, Canada and the Northern States of the American Union, were visited by an earthquake vibration of a more general and impressive character than any that has occurred for many years, and we propose to present to our readers such reports as have reached us with respect to its distribution, time, and local intensity, and to add for comparison and future experience a summary of the earthquakes that have occurred in Canada since its colonization, and some remarks on the laws of these phenomena as far as they have been ascertained.

In Canada the earthquake of the 17th. was experienced in its greatest intensity in the lower part of the river, and with diminished force as far west as Hamilton. In the United States, in like manner, it was most violent on the Atlantic coast and extended westward apparently with less intensity as far as Troy. Between Hamilton and Father Point it was felt throughout the whole of Canada. At River Ouelle and other places in the lower St. Lawrence it was so violent as to throw down chimnies and damage walls, and several severe shocks were felt. In Upper Canada there appears to have been but one shock and this comparatively feeble. We have at present no information as to the extension of the vibrations to the north of Canada and to the south of the Northern States.*

The following list of places in which observations were made of the time and intensity of the shocks has been compiled chiefly from the newspapers, to which much credit is due for the careful and intelligent manner in which they have collected and recorded the facts.

The places have been arranged in the order of their longitudes, from east to west, and it will be observed that the time is earlier in eastern localities, but on comparing Bic and Belleville nearly nine degrees of longitude apart, it will be seen that the difference of time is only a little less than that due to the difference of longitude. The Hamilton observation would give an earlier time, but as the shock was slight and the testimony of only one observer was recorded, there may be an error. The shock thus appears to have been nearly simultaneous throughout Canada.

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* It was felt in New Brunswick also.

Bic, 6 a. m., Three shocks at intervals of some seconds, noise continued for 10 minutes.

Green Island, 6 a. m.

Rivière du Loup, 6 a. m. A series of shocks lasting nearly five minutes. A schooner off this place experienced a shock resembling that of striking on a sand-bank, and the waters of the Gulf were unusually agitated.

River Ouelle, 6.15 a. m. Very violent, damaging walls and throwing down chimneys, especially in low grounds.

Eboulements, near Murray Bay, 5.30 a. m. Violent. Five other feeble shocks in rapid succession, another at noon and another at 5 p. m. This is the only place where these latter shocks are mentioned, but the hour of the first is probably an error, as Bay St. Paul, quite near Eboulements, agrees in this respect more nearly with other places.

Bay St. Paul, 5.50 a. m. Violent shock; chimneys fell.

St. Thomas (Montmagny) 6 a. m. Two shocks.

St. Joseph de la Beauce, 6.10 a. m.

Quebec, 5.50 a. m. Several shocks, severe, especially in lower parts of the city and in the environs; but less so than at River Ouelle, &c.

Leeds, Megantic, 6.10 to 6.15 a. m.

Richmond, 5.45, a. m.

Three Rivers, about 6 a. m. Shocks felt for two minutes.

Granby, about 6 a. m.

St. Hyacinthe, 5.45 a. m. Three shocks continuing more than a minute, buildings reported damaged.

Maskinonge, 6 a. m. Shocks felt for more than a minute, supposed to be from North to South.

Montreal, 5.50. Two or three perceptible shocks, felt less on the Mountain than on lower ground.

St. Martin, Isle Jesus, 5.55. At Dr. Smallwood's observatory, two distinct and smart shocks. The wave passed from East to West. Barometer 29.964 inches, temperature 40° 3, wind N. E., cloudy.

Cornwall, 6 a. m.

Prescott, 5.30 a. m.

Belleville, 5.30 a. m. One shock.

Hamilton, 4.45, a. m.

In all or nearly all of the above places the earthquake was pre-

ceded by a rumbling noise which gradually decreased after the vibrations had passed. The difference of duration ascribed to the shocks appears to arise mainly from the circumstance that some observers include the continuance of vibration in buildings, &c., as well as that of the subterranean sound; and in this way it is probable that by some persons two or more shocks have been regarded as one.

The following graphic account of the phenomena as observed at River Ouelle appeared anonymously in a Quebec paper, and is the most detailed statement we have seen of the effects of the earthquake in those localities in which it was most violent,

Rivière Ouelle, 17 octobre, 1860.

" Ce matin trois fortes secousses de tremblement de terre sont venues jeter la frayeur au milieu de nos populations.

" Les batisses situées de chaque côté de notre rivière ont souffert généralement. Une cheminée chez E. Chas. Têtu, deux chez M. C. Casgrain, une chez M. Frenette, une chez Auguste Casgrain, une chez madame Frs. Casgrain, et chez une dizaine d'autres personnes ont été renversées. La croix de notre Eglise et le coq sur qui la montait sont à terre; les murs des notre belle église sont lézardés. Les secousses étaient effrayantes; la première, la plus violente, a commencé à six heures et quart, et a duré quatre minutes et 40 secondes, très violentes durant dix secondes et s'affaiblissant graduellement; la secousse la plus faible à six heures et vingt minutes, a duré trois à quatre secondes, et la troisième a commencé a six heures et demie, et n'a duré que deux à trois secondes; mais, comme la première, c'était un choc saccadé faisant danser les meubles, décrochant les cadres, les horloges, etc.

" Les secousses ont été plus faibles sur les hauteurs, que dans les plaines, de sorte que mes bâtisses se sont trouvées à l'abri des accidents.

" Jamais de mémoire de nos habitants, nous n'avons eu des coups aussi forts. Je suis demeuré devant mon horloge tout le temps pour m'assurer de sa durée, afin de pouvoir computer avec d'autres endroits la marche de ce grand et terrible phénomène.

" Un bruit sourd et fort nous a d'abord averti et ensuite sont venus les secousses et les craquements."

The observation of Dr. Smallwood that the wave proceeded from east to west accords with that of some other observers and may be regarded as correct. At the same time the nearly simul-

taneous occurrence of the shock throughout Canada, perhaps indicates that the wave did not move horizontally but reached the surface from a great depth and at a high angle as Perrey seems to suppose the earthquakes of Eastern America have usually done. It must however be observed that at the rate of propagation given by Mallet for earthquake waves through hard rock, which is not less than 10,000 feet per second, it is quite possible that even a horizontal wave may appear to be felt at the same instant at great distances.*

All the observers agree that the sound preceded the shock and continued after it, and that the first shock was the most violent; and it is also very generally noted that it was most severely felt on low ground and least so on rocky eminences. This last character which belongs to earthquakes generally, seems to arise from the greater resistance opposed to the vibrations by loose materials as compared with hard rocks.

It appears from the published lists that the late earthquake is the last of at least twenty-nine that have visited Canada since its discovery by Europeans, and we now proceed to give some account of these previous instances, availing ourselves mainly of the facts and conclusions stated by Mallet and Perry, the two most extensive and laborious collectors of earthquake statistics.

Mallet defines an earthquake as " the transit of a wave of elastic impression in any direction from verticality upward to horizontality in any azimuth through the crust of the earth, from any centre of impulse, or from more than one, and which may be attended with tidal and sound waves dependent upon the impulse and upon the circumstances of position as to sea and land." Such " earth-waves " travel outward from the centre of impulse with immense velocity and appear as upward shocks or undulating rolls according to the greater or less verticality of the motion. They may also be complicated with indirect shocks arising from unequal or circuitous transmission of the vibrations, and these complex shocks usually occur in great and destructive earthquakes.

The causes of these vibratory waves are too deep-seated to be directly known to us, but they must occur when any part of the crust of the earth is subjected to tension, and when this is suddenly relieved by fracture or otherwise, and again when any part of the earth's crust is left unsupported and collapses under the force

* See Mallet on the Dynamics of Earthquakes.—*Transactions Royal Irish Academy, Vol. XXI.*

of gravity. Geology teaches us to refer such effects to the slow expansion or contraction of great masses of rock under the influence of heat, to the disengagement of elastic gases under pressure, to the removal of matter from the interior to the surface by volcanoes, to the transference of sediment from the land to the sea basins. Such causes are constant and secular, and of course the precise time at which the tension or unsupported weight shall give way can scarcely be calculated, and may occur with suddenness and at irregular intervals; and so nice may be the balancing of opposing forces, that observation shows us that the attraction of the moon or an unusually low state of atmospheric pressure may overset the equilibrium and induce an extensive vibration of the solid crust of the earth, yet the actual causes of the phenomenon may have been for ages slowly preparing for it.

The fractured condition of the rocks of the earth shows that earthquakes have been occurring throughout all geological time, and they are by no means rare phenomena at present. For the whole earth their rate of occurrence is stated to be nearly 3 per month or 36 per annum; and no doubt very many are unrecorded and would considerably increase the average. But their distribution locally is very unequal. While in some spots slight earthquakes are of almost constant recurrence and in others great agitations of the earth are not infrequent, in other extensive regions no earthquakes are known to have occurred. Earthquakes are manifestly connected with the causes of volcanic action, and follow the same law of distribution on the surface of the globe; though in volcanic regions earthquakes and volcanic eruptions sometimes alternate, as if the suppression of the latter gave increased energy to the former. Hence volcanic vents have been regarded as safety valves to those pent-up *Seismic* agencies, as they have been called, which shake the pillars of the solid land.

In Mallet's map of the distribution of earthquakes, in the Report of the British Association for 1858, a belt of intense seismic activity runs from the Falkland Islands and Cape Horn along the Andes and Rocky Mountains, giving off a branch through Columbia to the West India Islands. It crosses over to Asia by the Peninsula of Alaska and the Aleutian Islands, and runs down through Kamtschatka, the Kurile and Japan Islands, from which it gives off a branch along the Ladrone Islands, but the main body crosses over to the Philippines, and from these a great crescent shaped patch stretches around Celebes, Java, and Sumatra. This crescent of the East India Islands seems to be

the most intense seat of earthquake force in the world. It sends off branches in different directions. One of these passes eastward and southwest through New Guinea and the New Hebrides to New Zealand, and probably beyond it to the Antartic continent, giving off a long branch through the Polynesian Islands. Another goes northward and spreads itself in Central Asia. A third running up the Malayan Peninsula and through northern India, Persia, and Asia Minor, passes along the south of Europe and extends to the Azores, giving off a faint branch through France and the British Islands to Iceland. The great earthquake band thus traced, includes nearly all the active volcanoes, except a few apparently isolated spots in the Ocean, like the Sandwich Islands. There are however broad sheets of the earth's surface traversed by the earthquake vibrations proceeding from this band of maximum action, and there are also subordinate bands of small intensity which have not been noticed in the above sketch. To the latter belongs the east coast of America, which seems to constitute a continuation of the West Indian branch, extending upwards along the Appalachian chain to Labrador, and perhaps completing the circle of the North Atlantic by a submarine continuation to Iceland.

We of course know nothing certainly of earthquakes in eastern America until after its colonisation by Europeans, yet this does not constitute a difference between America and the old continent so great as might at first sight be supposed. We know comparatively little of earthquakes even in the old world until the 16th century. Nothing more strongly indicates the little attention given to natural phenomena in the middle age of the earths history, than the fact that while the recorded earthquakes even in Europe and the neighbouring parts of Asia and Africa are only from 10 to 68 per century in the first 15 centuries of our era, they rise in the 18th century to 660 and in the 19th already amount to 925. No attention seems to have been given to earthquakes in the periods of classical antiquity and the middle ages, except when they proved very destructive or were supposed to be connected with some historical event. The great and otherwise alarming increase of earthquakes in modern times is in truth to be attributed principally to the revival of learning, to the invention of printing, and to the progress of the natural and physical sciences. Hence between the 15th and 17th centuries the recorded earthquakes in Europe and its vicinity rise suddenly

from 41 to 180, and the increase seems only to have been arrested in the 18th century, when these causes were in full activity. The progress of navigation in the Pacific, and the discovery of America, have, when we regard the whole world, also enormously increased the number of instances, so that the earthquakes for the whole world were in the 17th and 18th century 35.3 per annum and in the first half of the 18th century alone 3240 in all, while the total number from the 10th to the 15th centuries inclusive was only 532.

The earliest earthquake in Eastern North America, in the catalogue prepared by Mr. Mallet for the British Association, is that felt in New England in 1638. The earliest in Canada is that of 1663. The following list taken from the Report above referred to and other sources, includes all the subsequent earthquakes recorded as having affected Canada, or the neighbouring parts of America.

1638, June 2, *New England.*—Violent, two shocks, direction N. W. & S. E., houses thrown down.
1658, April 4, " Violent.
1660, January 31, " "
1662, January 26, " Violent, three shocks, chimneys thrown down.
" Nov. 6, "
1663, February 5, CANADA.—Very violent, succeeded by minor shocks until July following, ice broken up, rivers discoloured, cliffs and banks thrown down, buildings injured: extended to Nova Scotia and New England.
1665, February, 24, " At Tadoussac and Malbaie, violent.
" Oct. 15, " Violent, accompanied by loud noise.
1668, not dated, *New England.*
1669, " "
1727, Nov. 9, " Violent, followed by slight shocks, direction N. E. to S. W., loud explosions, earth opened at Newbury, and ejected sand, &c.
1728, January 30, *New England.*
" Aug. 2, " Slight shocks continued from November 1727 to this date.
1729, March 25, " Repeated slight shocks from this date till 1741.
1732, September 5, CANADA, *New England* and as far as Maryland, buildings injured.
1737, February 6, *New England.*—At Boston, one shock.

" December 7, " and New York, three shocks, buildings injured.
1738, Oct. or Nov., " At Boston.
1741, December 6, " Boston, &c., slight.
1744, May 16, Canada.—At Quebec a considerable vibration.
" June 3, *New England.*—At Cambridge, slight.
1746, Feb. 2, " At Boston.
1755, Oct., Canada.—No shocks, but unusual rise and fall of water in Lake Ontario. On Nov. 1st of this year occurred the great Lisbon earthquake which was felt over the Atlantic and inthe West Indies, but I find no record of its being felt in Canada.
" Nov., *New England* and Eastern U. States to Maryland. Also Nova Scotia. Three or four shocks, two of them violent. Houses were damaged.
" Nov. 21, " At Boston.
" Dec. 19, " Same region as on the 18th, but slightly.
1756, January 1, *New England.*—At Boston.
" November 16, " "
" December 4, " "
1757, July 8, " "
1758, February 2, " "
1760, " 3, "
" November 9, " At Boston, slight.
1861, February, " "
" March 12, *North America.*—Violent shocks.
" " 16, *New England.*—Boston.
1763, October 30, *Philadelphia.*—Violent.
1766, February 2, *New England.*—Especially Massachusetts and Rhode Island.
" August 25, *New England.*—Newport, R. I.
" Dec. 17, " Portsmouth, N. H., a violent shock.
1776, February 2, " In Rhode Island.
1783, July 29, *New York.*—Rather violent.
1785, January 2, *New England.*—At Cambridge, shocks at same time at Baltimore.
1786, November 29, *New England.*—At Cambridge.
1787, February 25, " "
1791, May 16, " At Rast Haddam, Conn., which was visited by a series of slight shocks, continuing through aeveral years.
" April 18, *New England.*—To Pennsylvania, a severe shock followed by slighter ones.
" December, Canada.—Severe shocks at St. Paul's Bay, walls cracked, &c.

1796, February, CANADA.—A violent shock, rocks fell from cliffs at Niagara.
1799, March 17, *Philadelphia.*—One shock.
1800, November 29, " A severe shock.
" December 25, *New England.*—Various places.
1801, November 12, *Philadelphia.*
1804, May 18, *New York.*
1810, Nov. 9, *New England.*—Several places, a severe shock.
1811, December 16, At this date commenced the terrible earthquakes which were felt extensively in the valley of the Mississippi and in various parts of the Eastern and Western States until 1813. The great earthquake of Caraccas occurred in March 1812.
1816, September 9, CANADA.—A severe shock felt at Montreal.
" " 16, " A second shock, less violent.
1818, Oct. 11, " Felt near Quebec.
1819, August 15, " At St. Andrews.
" November 10, " At Montreal, slight. Followed by an awful storm with rain impregnated with matter like soot.
1821, February, " At Quebec, a slight shock.
1823, May 30, " On shore of Lake Erie, slight but water of
" lake rose to height of 9 feet.
1824, July 9, *New Brunswick.*—A severe shock.
1827, August 23, *New England.*—At New London, Conn.
1828, August 20, CANADA.
1829, January, *New York.*—At Portsmouth.
1831, July 14, CANADA.—At Murray Bay, Beauport, &c.; walls and chimnies were thrown down at the former place.
1832, *Nova Scotia.*—Slight.
1833, March and April, CANADA.—Several shocks at Murray Bay, &c.
1837, April 12, *Hartford*, Conn.—Very slight.
1840, August 9, *New England.*—Especially in Connecticut, several slight shoks.
" September 10, CANADA.—At Hamilton, a violent shock apparently from W. to E.
" November 11, *Philadelphia.*—A severe shock.
" " 14, *New Haven.*—In Connecticut.
1841, January 25, *New York.*—Several shocks, W. to E.
" Spring, CANADA.—Said to have been felt at Quebec, but regarded as uncertain.
1842, November 8 and 9, CANADA.—Montreal, Three Rivers, &c., severe shocks and agitation of the River.
1844, " " At Montreal.
1847, " " Felt at Montreal.

1855, February 8, *Nova Scotia, New Brunswick*, and *New England* slight.
" " 19, *New England.*—In Maine.
1856, May 1, CANADA.—At Ottawa and its vicinity, (See Canadian Nat. Vol. I).
1857, October, " In the Upper Province.
1858, January 15, CANADA.—At Niagara, slight.
" May 10, " At Richmond, slight.
" June 27, *New England.*—At New Haven, slight.
1859, CANADA.—At Metis.

On comparing the above table with the deductions of Mallet and Perry for the entire globe, we perceive the applicability to Canada of the law ascertained by them, that the greatest and most frequent shocks occur a little after the middle and toward the close of each century. Thus in Canada and New England the years from 1658 to 1663, from 1756 to 1766, and from 1791 to 1796, were periods of special seismic activity, and in the present century our most severe shock has been in 1860, and judging from the previous centuries will no doubt be followed by others.

With respect to seasons of the year, the published catalogues show that January presents the maximum, and May and June the minimum activity for the northern hemisphere, and that the autumn and winter months are those in which earthquakes occur most frequently. Nearly in accordance with this, in the above list the earthquakes are distributed as follows:—

January	8	July	4	Spring	16
February	4	August	6	Summer	12
March	5	September	4	Autumn	25
April	4	October	7	Winter	30
May	6	November	14		
June	3	December	8		

We have only to add that the present article is to be regarded only as an imperfect and hasty summary, and that we shall gratefully receive and publish, in a supplementary article, any information which our correspondents may supply respecting either the late earthquake or any of its predecessors. J. W. D.

ARTICLE XLVII.—*The Meteor of July* 20, 1860, by C. S. LYMAN. From Silliman's Journal, September, 1860.

This remarkable meteor was visible over a portion of the earth's surface at least a thousand miles in length, (N. N. W. to S. S.E.)

by seven or eight hundred in width; or from Lake Michigan to the Gulf Stream and from Maine to Virginia. The newspapers have contained many notices of its appearance as seen at various places within these limits, but most of these accounts are too vague to be of any scientific value. We are not yet in possession of a sufficient number of good observations for a final discussion of the phenomena presented, and can only at this time notice briefly a few of the best that have come to hand, and state some approximate results derived from them respecting the height of the meteor above the earth, the direction of its path, &c.

At New Haven, it was seen, during a portion of its flight, by several members of the Scientific Faculty at the house of Prof. J. A. Porter, and pains were at once taken to fix its apparent path by reference to parts of the building, tree-tops, stars, &c., near which it had been seen, and also to determine its time of flight, by noting the time required to repeat the various acts performed while it was in sight. The bearings and altitudes of the points noted for fixing the path were subsequently determined instrumentally. Independent data of the same kind were also obtained by going with many different observers to the places occupied by them at the time, and observing with compass and quadrant the path in the sky pointed out by each, and noting the time for each in the manner alreadv indicated.

By laying down these bearings and altitudes on a globe, a normal or average path was obtained, which cuts the horizon at N. 62° W. and S.. 62° E., and gives a maximum altitude of 53°, in a direction S. 28° W.

The time of flight for the different observers, determined as above stated, ranged from 10 to 20 seconds—giving an average of fourteen or fifteen seconds, which agrees with the careful estimate made at the time by the observers at Prof. Porter's.

Valuable observations have also been received from individuals in different places, some items of which we proceed to state. They will be given more fully hereafter.

Mr. J. D. Lawson, of New York, saw the meteor from the corner of Fourth street and Broadway, and has furnished data which gives for maximum altitude (N.) $56\frac{3}{4}$°. Another independant observation at the same spot, as published in the *Journul of Commerce*, gives from data subsequently obtained by Prof. H. A. Newton, an altitude of about 55°. We use for N. Y. 56° as the mean of the two.

Mr. F. Huidekoper, of Meadville, Pa., makes the altitude at that place 39° 30′ from the northern horizon; the point of disappearance at altitude 3° 30′, and 10° 45′ S. of east; time from crossing meridian till disappearance, 10 to 12 seconds.

Mr. W. King, a surveyor, at Erie, Pa., makes the altitude 44°, and point of disappearance in a cloud due east at an altitude of 22°.

Mr. S. B. McMillan, of E. Fairfield, Ohio, reports it as having been seen, "moving from a point about 10° E. of N. to within as much of a due east direction," attaining an altitude of 15°.

Rev. T. K. Beecher at Elmira, N. Y., saw it pass very nearly through his zenith, and "so very close to" μ Lyræ "as to quench, if not eclipse it." This star was then about 11° from his zenith and in azimuth S. 76½° E. The meteor separated into two parts with an explosion when near the zenith.

Other observations (not now at hand), which have been used in obtaining our results, have been received from Mr. B. V. Marsh of Philadelphia, and Prof. Hallowel, of Alexandria.

A comparison of these observations, and a few of the best that have been published, give approximate results as follows:

(1.) The vertical plane in which the meteor moved cuts the earth's surface in a line crossing the northern part of Lake Michigan, passing through, or very near to, Goderich on Lake Huron (C. W.), Buffalo, Elmira and Sing Sing, N. Y., Greenwich, Con., and in the same direction across Long Island into the Atlantic.

(2.) In this plane the path that best satisfies the observations is sensibly a straight line approaching nearest to the earth (41 miles) at a point about south of Rhode Island, and having an elevation of 42 miles above Long Island Sound, of 44 over the Hudson, 51 at Elmira, 62 at Buffalo, 85 over Lake Huron, and 120 over Lake Michigan. The western observations, however, which are few and imperfect, seem to indicate a somewhat greater elevation than this for the western part of the path. Possibly, therefore its true form may have been a curve convex towards the earth, resulting from the increasing resistance of the atmosphere as the meteor descended into denser portions of it. The observations made on this side of Buffalo, which are somewhat numerous and many of them good, are very well satisfied by the straight path already described. Further and more accurate observations beyond Buffalo are greatly needed for determining the true form and po-

sition of the orbit, both in respect to the earth's surface and in space.

(3.) The close approximation to parallelism to the earth's surface of the eastern portion of the observed path leaves it a matter of doubt, considering the imperfection of the observations, whether the meteor finally passed out of the atmosphere and went on its way in a disturbed orbit, or descended gradually into the Atlantic. The former supposition is perhaps the more probable, especially if the path was curved, as above suggested, instead of a straight line.

(4.) The meteor exhibited different appearances in different parts of its course. It seems to have been observed first as a single body, more or less elongated, gradually increasing in brilliancy, throwing off occasionally sparks and flakes of light, until it reached the neighbourhood of Elmira, N. Y. Here something like an explosion occurred, and the meteor separated into two principal portions with many subordinate fragments all continuing on their course in a line behind each other, and still scattering luminous sparks along their track, until a point was reached about south of Nantucket, when a second considerable explosion took place, and afterwards the principal fragments passed on till lost to view in the distance. The most trustworthy observations represent the meteor as disappearing while yet several degrees above the horizon, (generally from 3° to 6° or 8°). Besides the actual changes of form which the body successively underwent, apparent changes would present themselves to each observer arising from change of direction in which the meteor was seen.

(5.) It is not easy, from the observations in hand, to determine with much accuracy the volocity of the meteor while passing through our atmosphere. The time of flight is doubtless largely over-estimated by most observers, especially those unaccustomed to measure intervals of a few seconds. Timing with a watch, a repetition of the acts performed during the flight of the meteor usually reduces the interval to not more than one third, or even one fifth, of the observer's own estimate. From 15 to 30 seconds is a fair range for good observations, and probably to no observer was the meteor in sight over 45 seconds or a minute, although a minute and a half and two minutes are very common estimates A comparison of the most probable estimatee of time with the length of path observed, gives a velocity ranging from eight to fifteen miles a second. Probably 12 or 13 miles is a tolerable

approximation. This, allowing for the earth's motion in its orbit, gives 26 or 27 miles a second as the actual velocity of the meteor in space. Its relative velocity may have been much greater when just entering the atmosphere, than after encountering its accumulated resistance.

(6.) The actual diameter of the luminous mass, taking its apparent diameter as nearly equal to that of the moon, (the estimate of many observers nearest its track) must have been from one fifth to one-third of a mile. Many estimates would make it still larger. The two principel heads when passing New Haven must have been from one to three miles apart.

(7.) A report is mentioned by many observers as having been heard from one and a half to five minutes after the meteor passed. The least time in which such a report could have been heard, taking the usual constant for the velocity of sound (1090·47 feet a second) would be about three minutes and a half. This is a point of much interest, and needs to be investigated.

The "rushing sound" spoken of by many as heard while the meteor was passing, is of course to be attributed to imagination.

ARTICLE XLVIII.—*La Verrier's Report on the Solar Eclipse of July*, 18, 1860, *at Tarazona.* From Silliman's Journal, September, 1860.

At the last moment, and after our notices of this phenomenon were printed (see pp. 281, 285, 288) we have received LeVerrier's Report of the Observations of the French Expedition to Spain, made to the Minister of Public Instruction, which we hasten to lay before our readers, slightly condensed, although other matters which some of our correspondents will naturally look for here are thereby displaced. The interest with which Le Verrier's new views of the physical constitution of the Sun will be read is our apology to all such.

Le Verrier was accompanied to Spain by Messrs. Yvon Villarceau, and Chacornac, who were occupied chiefly with determining the height and position of two or more of the luminous appendages. M. Foucault studied the corona, and made the photometric and photographic experiments. M. Le Verrier observed the astronomical phases of the phenomenon, and was also charged with the duty of obtaining an exact description of the whole scene. Two telescopes on Foucault's plan were devoted to the

measurements, being provided with micrometers of peculiar construction, devised by Yvon Villarceau for rapid and easy manipulations in the dark. Two excellent telescopes of 6 inch aperture (one for the use of the Spanish observers) were also provided, to which must be added the photographic apparatus, a meridian circle, chronometers, barometers, seekers, and lastly the great meridian instrument belonging to the War Department, and with which the longitude was determined—forming a grand total of scientific baggage which on the 28th of June, was dispatched for Spain. The outfit of the English expedition was even yet more considerable. Early in July, Mr. Yvon Villarceau joined the instruments at Tudela in the centre of Spain, on the banks of the Ebro, and immediately proceeded with them to Tarazona and to the chosen station called the *Sanctuaire*, 1,400 metres(=4592 feet) above the sea. M. Le Verrier and Foucault, fearing clouds, descended on the morning of the 18th to a plateau near the cemetery of Tarazona where the weather was magnificent during the whole eclipse. Passing the description of the contacts and observations for time, &c., we note that at totality they found the general illumination of the atmosphere much greater than the relation of former observers of total eclipses had led them to expect, so that they could read and write easily without using their lamps.

Says Le V.: "The first object which I saw in the field of the telescope after the commencement of totality was an isolated cloud separated from the moon's border by a space equal to its own breadth, the whole about a minute and a half high by double that length. Its colour was a beautiful rose mixed with shades of violet, and its transparency seemed to increase even to brilliant white in some parts. A little below on the right two clouds lay superimposed on each other, the smaller above, and the two of very unequal brilliancy. The rest of the western edge of the disc and the lower part showed nothing more than the corona, the light of which was perfectly white and of the greatest brilliancy. But 30° below the horizontal diameter on the east I discovered two lofty and adjoining peaks, the upper sides of both tinted with rosy and violet light, while the lower sides were brilliant white. I do not doubt that the toothed form I assign to these peaks is real, which as it contrasted with that of the first appendages I have described, I verified with great care; moreover, in shifting the telescope, whose high power permitted a sight of only a small

part of the solar disc at one time, I saw a third peak a little higher also tooth-formed, and resembling the two others in colour and form, differing only in its larger dimensions. The remainder of the disc offered nothing remarkable, and on returning to the upper region I found the two first described clouds unchanged. As the moment of reappearance of the Sun approached, and while waiting for the first rays, I made, during about 20^s, perhaps my most important observation. The margin of the disc which two minutes before was entirely white was now tinged by a delicate fillet of unapreciable thickness of a purplish red—then as the seconds glided by, this fillet enlarged by degrees and formed soon around the black disc of the moon, over a breadth of about 30°, a red border perfectly defined in thickness, crescent-formed and with an irregular outline above. At the same instant the brilliancy of the part of the corona which during the last second emerged from behind the moon's disc was exalted so rapidly that I was in doubt if the sun's light was not returned. It was only on the reappearance of the direct rays, the brightness of which obliterated in turn the corona, that I was sure of the nature of three phenomena present at the same time, which I thus sum up.

1. The visible parts of the emergent sun over its whole breadth and up to the height of seven or eight seconds was covered by a bed of rosy clouds, which appeared to gain in thickness as they emerged from behind the disc of the moon. Must we believe that the entire surface of the sun is overspread at a small elevation, as it is strewn with faculæ, and that the roseate clouds are emanations, appearing like spots on the sun's disc ?

2. The intensity of the light in the corona which is always white, varies with great rapidity in the immediate vicinity of the sun's disc.

3. The reappearance of the direct sunlight was at 3^h 0^m 49^s·0. Total obscuration continued 3^m 14^s·3. The disc of the moon completely cleared the sun at 4^h 6^m 20^s.

(M. Focault's interesting observations on the photographs, etc., are unavoidably postponed for want of room.)

Le Verrier goes on to state that the observation of his party authorise, in his opinion, important modifications in the generally received notions respecting the physical constitution of the sun. Arago in his notice of solar eclipses, says—" where exist the reddish flames with well defined outlines which during the total eclipse of the 8th of July, 1842, passed considerably beyond the

outlines of the lunar disc? These flames were either in the moon or in the sun, or in our atmosphere; unless, indeed, denying their actual existence, we regard them as an effect of light, for example as phenomena of diffraction.

The two last suppositions have found few partizans. Before adopting any hypothesis it is necessary to decide by observation a certain feature of the phenomenon. During the eclipse, the disc of the moon moves across the disc of the sun. But do these reddish clouds follow the moon in its movement? or does each cloud remain invariably above the same point on the solar disc? In the first case the origin of the luminous clouds is to be sought in the moon; in the second case, these clouds belong to the sun. For clearness sake, assume the latter supposition, and observe what appearances should present themselves when the lunar disc passes like a screen over the whole. Consider first a cloud situated on the east and adherent to the sun's limb. This object will be visible at the instant when totality commences. The advancing moon will regularly, at the rate of a half second of arc in a second of time, cover with its imb successively the lower, then the middle and lastly the higher portions—thus constantly diminishing the height of the cloud. For a cloud situated on the west these appearances will be reversed, its magnitude increasing as the moon gradually uncovers it. If then the roseate appendages seen during a total eclipse, depend on the sun, the fact should appear by the variation in height between those which appear in the east and the west. The phenomena will appear otherwise if the clouds appertain to the moon.

In the absence of equatorial solar clouds, the question in dispute can still be decided by observations on those seen on the south or north of the disc. The height of these clouds ought not to vary it is true, whether they belong to the moon or to the sun, but in the latter case carried away by the sun they would be displaced in the lunar disc with a certain velocity, while if they are adherent to the moon's disc, they would not be displaced. Hence the study of the height of the luminous clouds, whether east and west or north and south, has the highest interest. All the elements of the desired demonstration are found in the Spanish observations. In my first report, I mentioned the successive increase in thickness of a band of rosy clouds visible from the east to the end of the eclipse. Messrs. Yvon Villarceau and Chacornac have carefully noted the motions of a cloud, situated on the north

This cloud according to M. Villarceau, in two minutes time was displaced $3\frac{1}{2}°$ on the moon's disc, in moving to the west. The measurement of M. Chacornac's cover over an interval of six minutes in time, in which the cloud moved $11\frac{1}{2}°$.

Beautiful observation, and one which could not have been hoped for! We see that the duration of the motion studied by Chacornac, much exceeds the time of total obscuration. The last measure was made more than three minutes after sun-light had reappeared! It is important to note, among other points that this was not done with a cloud vaguely seen after the return of sun-light, but fortunately it was a measurement so carefully made as to be a gurantee against the possibility of illusion. It should be added that the displacement of the luminous cloud determined by observations made at the *Sanctuaire*, is precisely, equal to that required by calculation, assuming the cloud to belong to the sun. There remains, then, no foundation for a doubt, as to the nature of the rosy clouds which have been variously called flames, mountains, protuberences, and clouds.

The observation on one of the appendages, perfectly isolated from the disc of both sun and moon and of a sharply pronounced character, and on the other the appearance of a rosy band on the west at the moment of emersion, and the rate of motion of a second appendage, fixed by Villarceau and Chacornac, prove that these objects belong to the sun. Let us then hereafter give the name of *solar clouds* to the rosy appendages which become visible when the solar light is sufficiently dimmed.

A few words more will finish the description of the phenomenon and of the observatians. Ismaïl Effendi, a young Egyptian attached to the Paris observatory for three years past, a very expert astronomer, and who accompanied the French expedition to Spain, has sent me a drawing which proves the appearance of luminous clouds in the east immediately before the commencement of the eclipse. The clouds in question form a slightly elevated but continuous band embracing 95° of the outline of the sun. This band was not long visible, but was eclipsed behind the lunar disc, and it had in effect ceased when I passed over this region in exploring the whole periphery with a power which allowed me to see only portions successively.

The magnetic observations were made at Paris, the variations being sensibly simultaneous for the whole of Europe, and M. Desains, who took note of the maguetic observations, detected no perturbations during the eclipse.

Physical constitution of the Sun.—A reconstraction or even a complete abandonment of the theory hitherto prevalent as to the physical constitution of the sun appears to me essential. It must give place to one far more simple.

We have been hitherto assured that the sun was composed of a central dark globe; that above this globe existed an immense atmosphere of sombre clouds, still higher was placed the photosphere, a self-luminous, gaseous envelope, and the source of the light and heat of the sun. Where the clouds of the photosphere are rent, says the old theory, the dark body of the sun is seen in the spots which so frequently appear. To this complex constitution must be added a third envelope formed of the accumulation of roseate clouds.

Now, I fear that the greater part of these envelopes are only fictious—that the sun is a body, luminous, simply because of its high temperature, and covered by an unbroken layer of roseate matter whose existence is now proved. This luminary thus formed of a central nucleus, liquid or solid, and covered by an atmosphere, falls within the law common to the constitution of celestial bodies.

[M. Le Verrier goes on to discuss with some detail the solar spots in the light of these new views, but this we must defer for another occasion. It is certain that a subject of so much interest will command much consideration from physicists and astronomers and we will take care to give it the attention it deserves.

Nor will the question be settled peaceably—already M. Faye (*Comptes Rend.*, Aug. 13) in presenting to the French Academy a long letter from Baron Feilitzsch with an account of his observations (also in Spain), declares it to be his opinion as well as that of Baron F. that the eclipse of 1860, furnishes the most decisive evidence in favour of the opinion which refers the corona and the luminous clouds to simple optical appearances, and not to the essential constitution of the sun or of his atmosphere. M. Faye adds that the opinion appears to be confirmed by a comparison of the results of other observers— that the sun has no atmosphere and that the appearance are purely optical!—Ed.]

MISCELLANEOUS.

BRITISH ASSOCIATION.

OXFORD, JUNE 27.

(*From the Athenæum, January &c.*, 1860.)

A day of sun and cloud, warm, soft, and sometimes bright, ushered in the Meeting of the British Association for the Advancement of Science. The Prince Consort came down to Oxford to resign the Presidency of the Association. He was received with the customary acclamations, by a large and brilliant assembly, who filled the Sheldonian Theatre in almost every part. The Chancellor, Vice-Chancellor and all the heads of the University were present, as well as the men of science from all parts of Europe. After a few graceful words on the part he had himself taken in watching and fostering the progress of Science during the past year, and on the merits of his successor in the Presidential Chair, the Prince Consort made way for Lord Wrottesley, who rose and delivered the annual discourse.

The President's Address.

Gentleman of the British Association,—If, on taking this Chair for the first time as your President, I do not enlarge upon my deficiences for adequately filling the responsible office to which you have done me the honour to elect me, I hope you will believe that I am not the less sensible of them.

Science in Oxford University.

We are now once more assembled in this ancient and venerable seat of learning; and the first topic of interest which presents itself to me, who owes to Oxford what academic training I have received, is the contrast presented by the state of Science and the teaching of Science in this University in the autumn of the year 1814, when my residence here commenced, and for five years afterwards, with its present condition. As the private pupil of the late Dr. Kidd, and within a few yards of the spot from which I have now the honour to inaugurate the Meeting of this distinguished Association, I first imbibed that love of Science from which some of the purest pleasures of my life have been

derived; and I cannot mention the name of my former Tutor without acknowledging the deep debt of gratitude I owe to the memory of that able, conscientious and single-hearted man.

It was at this period that a small knot of Geologists, headed by Broderiph, Buckland, the two Conybeares and Kidd, had begun to stimulate the curiosity of the Students and resident Graduates by lectures and geological excursions in the neighbourhood of this town. The lively illustrations of Buckland, combined with genuine talent, by degrees attracted crowds to his teaching; and the foundations of that interesting science, already advancing under the illustrious Cuvier in France, and destined soon to spread over Europe, were at this time fairly laid in England within these classical Halls. Many a time in those days have my studies been agreeably interrupted by the cheerful laugh which invariably accompanied the quaint and witty terms in which Buckland usually announced to his brother geologists some new discovery, or illustrated the facts and principles of his favourite science. At the time, however, to which I refer, the study of physical science was chiefly confined to a somewhat scanty attendance on the Chemical Lectures of Dr. Kidd, and on those on Experimental Philosophy by Rigaud; and in pure mathematics the Fluxional Notation still kept its ground. In the year 1818, Vince's Astronomy, and in the following year the Differential Notation, were first introduced in the mathematical examinations for honours. At that time, that fine foundation the Radcliffe Observatory was wholly inactive; the Observer was in declining health and the establishment was neither useful to astronomical students, nor did it contribute in any way to the advancement of astronomical science. Even from the commencement of the present century, and in proportion as the standard of acquirement in classical learning was gradually raised by the emulation excited by the examinations for honours, the attendance on the above-mentioned Lectures gradually declined: but a similar cause enhanced the acquirements of students in pure and applied mathematics, and the University began to number among its Graduates and Professors men of great eminence in those departments of knowledge. Nor were the other sciences neglected: and as Chairs became vacant, or new Professorships were established, men of European reputation were appointed to fill them. In proof of all this, I need only direct attention to the names on the roll of Secretaries, Vice-Presidents, and Presidents of Sections,

to convince you that Oxford now contains among her resident Graduates men amply qualified to establish and advance the scientific fame of that University, of which they are the established ornaments.

Museum—Study of Nature.

I have already alluded to some particulars in which this great University has advanced in the career of scientific improvement, but everything else has been somewhat thrown into the shade by the important event of this year, the opening of the new Museum. The University could have given no more substantial proof of a sincere interest in the diffusion of science than in the foundation of this noble Institution; and I am sure that among the distinguished cultivators of science here assembled, there is not one who does not entertain a hearty desire for the success of the various efforts now in progress for the purpose of stimulating our University students to a closer contemplation and more diligent study of the glorious works of Nature,—a study which, if prosecuted earnestly, raises us in the scale of human beings and improves every moral and intellectual faculty. Towards the attainment of a result so much to be desired, the Museum will most powerfully contribute; and those who frequent it will owe deep obligations to Mr. Hope and the other benefactors who have generously added to its stores. But there are other causes in operation which tend to the same end; and among them, in addition to such improvements as arise out of the changes consequent on the recent Act of Parliament, may be mentioned the alteration in the distribution of University honours.

The institution of the School of Physical Science forms a most important feature in the recent changes, and will doubtless be productive of good results, provided that sufficient encouragement by way of reward be held out to those whose tastes lead them to devote themselves to those departments of knowledge, and that the compulsory arrangements in respect of other studies allow sufficient time to the student to accomplish his object. The great majority of physical students must necessarily belong to that class who have their subsistence to earn; and however earnest may be their zeal for mental improvement, there will be few candidates for the honours of the Physical School unless due encouragement be given to excellence in that department. It was therefore with sincere pleasure that I learned that three Fellowships had been founded at Magdalen College as prizes for proficiency in Natural

Science; and that at the same College, and at Christ Church and Queen's, scholarships and exhibitions had been provided for students who evince during their examinations the greatest aptitude for such studies. Moreover, the acquisition of a Radcliffe travelling Fellowship has been made to depend upon obtaining distinction in the School of Natural Science. In addition to all this, that beneficent and enlightened lady, Miss Burdett Coutts, has founded two Scholarships, with the view of extending among the clergy educated at the University a knowledge of Geology. Great hopes are justly excited in the minds of all well-wishers to the University by these events, and by reflection on the great change of opinion which must have taken place since the period when Dr Kidd, with the aid of Dr. Daubeny, Mr. Greswell and others, in vain attempted to raise a small sum, by private subscription, for building a modest receptacle for the various collections of Natural History. How little could these public-spirited individuals have foreseen, that within a few short years a sum approaching to 100,000*l.* would be appropriated to the building and furnishing that splendid monument of Oxford's good will to science, the New Museum!

Astronomy.

At the beginning of the year 1820, when the Astronomical Society was founded, the private Observatories in this country were very few in number. The establishment of that Society gave a most remarkable stimulus to the cultivation of the science which it was intended to promote. I can give no better proof of this than the fact that the *Nautical Almanac* now contains a list of no less than twelve private Observatories in the United Kingdom, at nearly all of which some good work has been done; and in addition to this, some Observatories, which have been since discontinued, have performed most important services—I may instance that of the two Herschels at Slough, and that of Admiral Smyth at Bedford.

It may not be uninteresting if I describe the nature and utility of some of the results which these several establishments have furnished to the world: I say the *world* advisedly, for scientific facts are the common inheritance of all mankind.

But first a word as to the peculiar province of the observatories which are properly called "public," such as the far-famed Institution at Greenwich. Their task is now more peculiarly to establish, with the last degree of accuracy, the places of the prin-

cipal heavenly bodies of our own system, and of the brighter or fundamental fixed stars which are about 100 in number. But in early stages of Astronomy, we were necessarily indebted to public Observatories for all the data of the science. On the other hand, their voluntary rivals occupy that portion of the great astronomical field which is untilled by the professional observer, roving over it according to their own free will and pleasure, and cultivating with industrious hand such plants as the more continuous and severe labours of the public astronomer leave no time or opportunity to bring to maturity.

The observations of our private observers have been chiefly devoted to seven important objects :—

First. The observing and mapping of the smaller stars, under which term I include all those which do not form the peculiar province of the public observer.

Secondly. The observations of the positions and distances of double stars.

Thirdly. Observations delineations, and Catalogues of the Nebulæ.

Fourthly. Observations of the minor planets.

Fifthly. Cometary observations.

Sixthly. Observations of the solar spots and other phenomena on the Sun's disc.

Seventhly. Occultations of stars by the Moon, eclipses of the heavenly bodies and other occasional extra-meridional observations.

And first as to cataloguing and mapping the smaller stars. This means, as you know, the accurate determination by astronomical observation of the places of those objects, as referred to certain assumed fixed points in the heavens. The first Star-Catalogue worthy to be so called, is that which goes by the name of Flamsteed's or the British Catalogue. It contains above 3,000 stars, and is the produce of the labours of the first Astronomer Royal of Greenwich,—labours prosecuted under circumstances of great difficulty, and the results of which were not given to the world in a complete form till many years had elapsed from the time the observations were made which was during the latter half of the seventeenth century. About the middle of the eighteenth century, the celebrated Dr Bradly, who also filled the post of Astronomer Royal, observed an almost equally extensive catalogue of Stars,and the begining of the nineteenth century gave birth to that

of Piazzi of Palermo. These three are the most celebrated of what may be now termed the ancient Catalogues. About the year 1830, the attention of modern astronomers was more particularly directed to the expediency of re-observing the stars in these three Catalogues,—a task which has much facilitated by the publication of a very valuable work of the Astronomical Society, which rendered the calculation of the observations to be made comparatively easy, and, accordingly, observations were commenced and completed in severel private and public Observatories, and from which some curious results were deduced as, *e. g.* sundry stars were found to be missing, and others to have what is called *proper motion.* And now a word as to the utility of this cource of observation. It is well observed by Sir John Herschel, "that the stars are the landmarks of the universe ; every well determined star is a point of departure which can never deceive the astronomer, geographer, navigator, or surveyor." We must have these fixed points in order to refer to them all the observations of the wandering heavenly bodies, the planets and the comets. By these fixed marks we determine the situation of places on the earth's surface, and of ships on the ocean. When the places of the stars have been registered celestial charts are constructed ; and by comparing these with the heavens, we at once discover whether any new body be present in the particular locality under observation and thus have most of the fifty-seven small or minor planets between Mars and Jupiter been discovered. The observations, however, of these smaller stars, and the registry of their places in Catalogues, and the comparisons of the results obtained at different and distant periods, have revealed another extrordinary fact no less than that our own sun is not fixed in space, but that it is constantly moving forwards towards a point in the constellation Hercules, at the rate as it is supposed, of about 18,000 miles an hour carrying with it the whole planetary and cometary system ; and if our sun moves probably all the other stars or suns move also, and the whole universe is in a perpetual state of motion through space.

The second subject to which the attention of private observers has been more particularly directed, is that of double or multiple stars, or those which, being situated very close to one another appear single to the naked eye ; but when viewed through powerful teloscopes are seen to consist of two or more stars. The measuring the angles and distances from one another of the two or more component stars of these systems, has led to the discovery that many of

these very close stars are,in fact acting as suns to one another and revolving round their common centre of gravity,each of them probably carrying with it a whole system of planets and comets, and, perhaps each carried forward through space like our own sun. It became then a point of great interest to determine whether bodies so far removed from us as these systems observed Newton's law of gravity and to this end ,it was necessary to observe the angles and distances of a great number of these douluble stars scattered everywhere through the heavens, for the purpose of obtaining data to compute their orbits. This has been done, and chiefly by private observers ; and the result is that these distant bodies are found to be obedient to the same laws that prevail in our own system.

The Nebulæ are as it were, systems or rings of stars scattered through space at incredible distances from our star system, and perhaps from one another ; and there are many of these mysterious clouds of light, and there may be endless invisible regions of space similarly tenanted. Now, the nearest fixed star of our star system whose distance has been measured, is the brightest in the constellation Centaur, one of the Southern constellations, and this nearest is yet so far removed, that it takes light, travelling at the rate of about 192,000 miles per second, three years to arrive at the earth from that star. When we gaze at it, therefore we see it only as it existed three years ago ; some great convulsion of nature may have since destroyed it. But there are many bright stars in our own system, whose distance is so much greater than this, as α Cygni for example that astronomers have not succeeded in measuring it. What, then must be the distance of these nebulæ, with which so much space is filled ; every component star in which may be a sun, with its own system of planets and comets revolving around it, each planet inhabited by myriads of inhabitants ! What an overpowering view does this give us of the extent of creation ! The component stars of these nebulæ are so faint, and, apparently, so close together, that it is necessary to use telescopes of great power and with apertures so large as to admit a great amount of light for the observation. We owe it more especially to four individuals that telescopes have been constructed at a great cost and with great mechanical skill, sufficiently powerful to penetrate these depths of space. Those four individuals are the Herschels, father and son, Lord Rosse, and Mr. W. Lassell. That praiseworthy nobleman, Lord Rosse began

his meritorious career by obtaining a First Class at this University and has, as you know, spent large sums of money and displayed considerable mechanical genius in erecting, near his own castle in Ireland, an instrument of far greater power than any other in the world; and with it he has observed these nebulæ, and employed skilful artists to delineate their forms : and he has moreover made the very curious discovery, that some of them are arranged in a spiral form, a fact which gives rise to much interesting speculation on the kind of forces by which their parts are held together. It were much to be wished that observations similar to these, and with instruments of nearly the same power, should be made of the Southern nebulæ also; that this generation might be able to leave to posterity a record of their present configurations. The distinguished Astronomer, Mr. W. Lassell, the discoverer of Neptune's satellite, has just finished at his own cost, an instrument equal to the task, mounted equatorially ; and I am not without hope that it may, at perhaps no very distant period, be devoted to its accomplishment. A recent communication from him to the Astronomical Society expresses satisfaction with the mounting of his instrument, and after many trials its great speculum has at last come forth nearly perfect from his laboratory.

Comets.

Of all the phenomena of the heavens, there are none which excite more general interest than comets—those vagrant strangers, the gipsies as they have been termed of our solar system, which often come we know not whence, and at periods when we least expect them : and such is the effect produced by the strangeness and suddenness of their appearance, and the mysterious nature of some of the facts connected with them, that while in ignorant times they excite alarm, they now sometimes seduce men to leave other employments and become astronomers. Now, though the larger and brighter comets naturally excite most general public interest, and are really valuable to astronomers, as exhibiting appearances which tend to throw light on the internal structure of these bodies, and the nature of the forces which must be in operation to produce the extraordinary phenomena observed, yet some of the smaller telescopic comets are, perhaps, more interesting in a physical point of view. Thus the six periodical comets, the orbits of which have been determined with tolerable accuracy,

and which return at stated intervals, are extremely useful, as being likely to disclose facts of which, but for them, we should possibly have ever remained ignorant. Thus, for example, when the comet of Encke, which performs its revolution in a period of a little more than three years, was observed at each return, it disclosed the important and unexpected fact, that its motion was continually accelerated. At each successive approach to the sun it arrives at its perihelion sooner and sooner ; and there is no way of accounting for this so satisfactory as that of supposing that the space, in which the planetary and cometary motions are performed, is everywhere pervaded by a very rarefied atmosphere or ether, so thin as to exercise no perceptible effect on the movements of massive solid bodies like the planets, but substantial enough to exert a very important influence on more attenuated substances moving with great velocity. The effect of the resistance of the ether is to retard the tangential motion, and allow the attractive force of gravity to draw the body nearer to the sun, by which the dimensions of the orbit are continually contracted and the velocity in it augmented. The final result will be that, after the lapse of ages, this comet will fall into the sun ; this body, a mere hazy cloud, continually flickering as it were like a celestial moth round the great luminary, is at some distant period destined to be mercilessly consumed. Now the discovery of this ether is deeply interesting as bearing on other important physical questions, such as the undulatory theory of light ; and the probability of the future absorption of comets by the sun is important as connected with a very interesting speculation by Prof. William Thomson, who has suggested that the heat and light of the sun may be from time to time replenished by the falling in and absorption of countless meteors which circulate round him ; and here we have a cause revealed which may accelerate or produce such an event.

Luminous bodies in the Sun.

On the 1st of September last, at 11h 18m A. M., a distinguished astronomer, Mr. Carrington, had directed his telescope to the sun, and was engaged in observing his spots, when suddenly two intensely luminous bodies burst into view on its surface. They moved side by side through a space of about 35,000 miles, first increasing in brightness, then fading away ; in five minutes they had vanished. They did not alter the shape of a group of large

black spots which lay directly in their paths. Momentary as this remarkable phenomenon was, it was fortunately witnessed and confirmed, as to one of the bright lights, by another observer, Mr. Hodgson, at Highgate, who, by a happy coincidence, had also his telescope directed to the great luminary at the same instant. It may be, therefore, that these two gentlemen have actually witnessed the process of feeding the Sun, by the fall of meteoric matter; but however this may be, it is a remarkable circumstance, that the observations at Kew show that on the very day, and at the very hour and minute of this unexpected and curious phenomenon, a moderate but marked magnetic disturbance took place; and a storm or great disturbance of the magnetic elements occurred four hours after midnight, extending to the southern hemisphere. Thus is exhibited a seeming connection between magnetic phenomena and certain actions taking place on the sun's disc—a connection, which the observations of Schwabe, compared with the magnetical records of our Colonial Observatories, had already rendered nearly certain. The remarkable results derived from the comparison of the magnetical observations of Captain Maguire on the shores of the Polar Sea, with the contemporaneous records of these Observatories, have been described by me on a former occasion. The delay of the Government in re-establishing the Colonial Observatories has hitherto retarded that further development of the magnetic laws, which would doubtless have resulted from the prosecution of such researches.

We may derive an important lesson from the facts above alluded to. Here are striking instances in which independent observations of natural phenomena have been strangely and quite unexpectedly connected together: this tends powerfully to prove, if proof were necessary, that if we are really ever to attain to a satisfactory knowledge of Nature's laws, it must be accomplished by an assiduous watching of all her phenomena, in every department into which Natural Science is divided. Experience shows that such observations, if made with all those precautions which long practice combined with natural acuteness teaches, often lead to discoveries, which cannot be at all foreseen by the observers though many years may elapse before the whole harvest is reaped.

Moon's Motion.

A curious controversy has lately arisen on the subject of the

acceleration of the Moon's motion, which is now exciting great interest among mathematicians and physical astronomers. Prof. Adams and M. Delaunay take one view of the question; MM. Plana, Pontécoulant, and Hansen the other. Mr. Airy, Mr. Main, the President of the Astronomical Society, and Sir John Lubbock support the conclusions at which Prof. Adams has arrived. The question in dispute is strictly mathematical; and it is a very remarkable circumstance in the history of Astronomy, that such great names should be ranged on opposite sides, seeing that the point involved is really no other than whether certain analytical operations have been conducted on right principles; and it is a proof, therefore, if any were wanting, of the extraordinary complexity and difficulty of these transcendental inquiries. The controversy is of the following nature:—The Moon's motion round the Earth, which would be otherwise uniform, is disturbed by the Sun's attraction; any cause therefore which affects the amount of that attraction affects also the Moon's motion: now, as the excentricity of the Earth's orbit is gradually decreasing, the average distance of the Sun is slightly increasing every year, and his disturbing force becomes less; hence the Moon is brought nearer the Earth, but at the rate of less than one inch yearly, her gravitation towards the Earth is greater, and her motion proportionably accelerated. It is on the secular acceleration of the Moon's mean motion, arising from this minute yearly approach, that the dispute has arisen; so infinitesimally small are the quantities within the reach of modern analysis. Mr. Adams asserts that his predecessors have improperly omitted the consideration of the effect produced by the action of that part of the Sun's disturbing force which acts in the direction of a tangent to the Moon's orbit, and which increases the velocity; his opponents deny that it is necessary to take this into account at all. Had not M. Delaunay, an able French analyst, by a perfectly independent process, confirmed the results of Prof. Adams, we should have had the English and Continential astronomers waging war on an algebraical question. On the other hand, however, the computations of the ancient lunar eclipses support the views of the Continent; but if Mr. Adams's mathematics are correct, this only shows that there must be other causes in operation, as yet undiscovered, which influence the result; and it is not at all unlikely, that this most curious and interesting controversy will eventually lead to some important discovery in Physical Astronomy.

Chemistry.

In Chemistry I am informed that great activity has been displayed, especially in the organic department of the science. For several years past processes of substitution (or displacment of one element or organic group by another element or a group, more or less analogous) have been the main agents employed in investigation, and the results to which they have led have been truly wonderful; enabling the chemist to group together several compounds of comparatively simple constitution into others much more complex, and thus to imitate, up to a certain point, the phenomena which take place within the growing plant or animal. It is not indeed to be anticipated that the chemist should ever be able to produce by the operations of the laboratory the arrangement of the elements in the forms of the vegetable cell or the animal fibre; but he may hope to succeed in preparing some of the complex results of secretion or of chemical changes produced within the living organism,—changes which furnish definite crystallizable compounds, such as the forminates and the acetates, and which he has actually obtained by operations independent ot the plant or the animal.

New Dyes.

Turning to the practical applications of chemistry, we may refer to the beautiful dyes now extracted from aniline, an organic base formerly obtained as a chemical curiosity from the products of the distillation of coal-tar, but now manufactured by the hundred weight in consequence of the extensive demand for the beautiful colours known as Mauve, Magenta, and Solferino, which are prepared by the action of oxidizing agents, such as bichromate of potash, corrosive sublimate, and iodide of mercury upon aniline.

Nor has the inorganic department of chemistry been deprived of of its due share of important advances. Schönbein has continued his investigations upon ozone, and has added many new facts to our knowledge of this interesting substance; and Andrews and Tait, by their elaborate investigations, have shown that ozone, whether admitted to be an allotropic modification of oxygen or not, is certainly much more dense than oxygen in its ordinary condition.

Geology—Antiquity of man.

The bearing of some recent geological discoveries on the great question of the high antiquity of Man was brought before your

notice at your last Meeting, at Aberdeen, by Sir Charles Lyell, in his opening address to the Geological Section. Since that time many French and English naturalists have visited the valley of the Somme in Picardy, and confirmed the opinion originally published by M. Boucher de Perthes, in 1847, and afterwards confirmed by Mr. Prestwich, Sir C. Lyell, and other geologists, from personal examination of that region. It appears that the position of the rude flint-implements, which are unequivocally of human workmanship, is such, at Abbeville and Amiens, as to show that they are as ancient as a great mass of gravel which fills the lower parts of the valley between those two cities, extending above and below them. This gravel is an ancient fluviatile alluvium by no means confined to the lowest depressions (where extensive and deep peat-mosses now exist), but is sometimes also seen covering the slopes of the boundary hills of chalk at elevations of 80 or 100 feet above the level of the Somme. Changes, therefore, in the physical geography of the country, comprising both the filling up with sediment and drift, and the partial re-excavation of the valley, have happened since old river-beds were, at some former period, the receptacles of the worked flints. The number of these last, already computed at above 1,400 in an area of fourteen miles in length, and half a mile in breadth, has afforded to a succession of visitors abundant opportunities of verifying the true geological position of the implements.

The old alluvium, whether at higher or lower levels, consists not, only of the coarse gravel with worked flints above mentioned but also of superimposed beds of sand and loam, in which are many freshwater and land shells, for the most part entire, and of species not living in the same part of France. With the shells are found bones of the Mammoth and an extinct Rhinoceros, *R. tichorhinus*, an extinct species of Deer, and fossil remains of the Horse, Ox, and other animals. These are met with in the overlying beds, and sometimes also in the gravel where the implements occur. At Menchecourt, in the suburbs of Abbeville, a nearly entire skeleton of the Siberian Rhinoceros is said to have been taken out about forty years ago, a fact affording an answer to the question often raised, as to whether the bones of the extinct mammalia could have been washed out of an older alluvium into a newer one, and so redeposited and mingled with the relics of human workmanship. Far-fetched as was this hypothesis, I am informed that it would not, if granted, have seriously shaken the proof of

the high antiquity of the human productions, for that proof is independent of organic evidence or fossil remains, and is based on physical data. As was stated to us last year by Sir C. Lyell, we should still have to allow time for great denudation of the chalk, and the removal from place to place, and the spreading out over the length and breadth of a large valley of heaps of chalk flints in beds from 10 to 15 feet in thickness, covered by loams and sands of equal thickness, these last often tranquilly deposited, all of which operations would require the supposition of a great lapse of time.

That the mammalia Fauna, preserved under such circumstances, should be found to diverge from the type now established in the same region, is consistent with experience; but the fact of a foreign and extinct Fauna was not needed to indicate the great age of the gravel containing the worked flints.

Another independent proof of the age of the same gravel and its associated fossiliferous loam is derived from the large deposits of peat above alluded to, in the Valley of the Somme, which contain not only monuments of the Roman, but also those of an older stone period, usually called Celtic. Bones, also, of the bear of the species still inhabiting the Pyrenees, and of the beaver, and many large stumps of trees, not yet well examined by botanists, are found in the same peat, the oldest portion of which belongs to times far beyond those of tradition; yet distinguished geologists are of opinion that the growth of all the vegetable matter, and even the original scooping out of the hollows containing it, are events long posterior in date to the gravel with flint implements nay, posterior even to the formation of the uppermost of the layers of loam with freshwater shells overlying the gravel.

The exploration of caverns, both in the British Isles and other parts of Europe, has in the last few years been prosecuted with renewed ardour and success, although the theoretical explanation of many of the phenomena brought to light seems as yet to baffle the skill of the ablest geologists. Dr. Falconer has given us an account of the remains of several hundred hippopotami, obtained from one cavern, near Palermo, in a locality where there is now no running water. The same palæontologist, aided by Col. Wood, of Glamorganshire, has recently extracted from a single cave in the Gower peninsula of South Wales, a vast quantity of the antlers of a reindeer (perhaps of two species of reindeer), both allied to the living one. These fossils are most of them shed horns;

and there have been already no less than 1,100 of them dug out of the mud filling one cave.

In the cave of Brixham, in Devonshire in and another near Palermo in Sicily, flint implements were observed by Dr. Falconer, associated in such a manner with the bones of extinct mammalia, as to lead him to infer that Man must have co-existed with several lost species of quadrupeds; and M. de Vibraye has also this spring called attention to analogous conclusions, at which he has arrived by studying the position of a human jaw with teeth, accompanied by the remains of a mammoth, under the stalagmite of the Grotto d'Arcis, near Troyes, in France.

Microscopy.

But I cannot takeleave of this department of knowledge without likewise alluding to the progress made in scrutinizing the animal and vegetable structure by mean sof the microscope—more particularly the intimate organization of the brain, spinal cord, and organs of the senses; also to the extension, through the means of well-directed experiment, of our knowledge of the functions of the nervous system, the course followed by sensorical impressions and motorial excitement in the spinal cord, and the influence exerted by or through the nervous centres on the movements of the heart, blood-vessels and viscera, and on the activity of the secreting organs;—subjects of inquiry, which, it may be observed, are closely related to the question of the organic mechanism whereby our corporeal frame is influenced by various mental conditions.

Conclusion.

I may perhaps be permitted to express the hope that the examples I have given of some of the researches and discoveries which occupy the attention of the cultivators of science may have tended to illustrate the sublime nature, engrossing interest and paramount utility of such pursuits, from which the beneficial influence in promoting the intellectual progress and the happiness and well-being of mankind may well be iuferred. But let us assume that to any of the classical writers of antiquity sacred or profane, a sudden revelation had been made of all the wonders involved in Creation accessible to man; that to them had been disclosed not only what we now know, but what we are to know hereafter, in some future age of improved knowledge; would they not have delighted to celebrate the marvels of the Creator's power? They would have

described the secret force by which the wandering orbs of light are retained in their destined paths ; the boundless extent of celestial spaces in which worlds on worlds are heaped ; the wonderful mechanism by which heat and light are conveyed through distances which to mortal minds seem quite unfathomable ; the mysterious agency of electricity destined at one time to awaken men's minds to an awful sense of a present Providence, but in after-times to become a patient minister of man's will, and convey his thoughts with the speed of light across the inhabited globe ; the beauties and prodigies of contrivance which the animal and vegetable world display, from mankind downwards to the lowest zoophyte, from the stately oak of the privæval forest to the humblest plant which the microscope unfolds to view ; the history of every stone on the mountain brow, of every gay-coloured insect which flutters in the sunbeam ;—all would have been described, and all which the discoveriers of our more fortunate posterity will in due time disclose, and in language such as none but they could command. It is reserved for future ages to sing such a glorious hymn to the Creator's praise. But is there not enough now seen and heard to make indifference to the wonders around us a deep reproach, nay, almost a crime. If we have neither leisure nor inclination to track the course of the planet and comet through boundless space ; to follow the wanderings of the subtle fluid in the galvanic coil or the nicely-poised magnet ; to read the world's history written on her ancient rocks, the sepulchres of stony relics of ages long gone past ; to analyze with curious eye the wonderful combination of the primitive elements, and tbe secret mysteries of form and being in animal and plant ; discovering everywhere connecting links, and startling analogies and proofs of adaptation of means to ends—all tending to charm the senses, to teach to reclaim a being who seems but a creeping worm in the presence of this great creation—what, I repeat, if we will not, or cannot, do these things or any of these things,—is that any reason why these speaking marvels should be to us almost as they were not ? *Marvels* indeed they are ; bnt they are also mysteries the unraveling of some of which task to the utmost the highest order of human intelligence. Let us ever apply ourselves seriously to the task, feeling assured that the more we thus exercise, and by exercising improve our intellectual faculties, the more worthy shall we be, the better shall we be fitted, to come nearer to our God.

Proceedings.—Section II.

Botany,—Darwin's Theory.

'On the Final Causes of the Sexuality of Plants, with particular Reference to Mr. Darwin's Work "On the Origin of Species by Natural Selection,"' by Dr. Daubeny.—Dr. Daubeny began by pointing out the identity betwen the two modes by which the multiplication of plants is brought about, the very same properties being imparted to the bud or to the graft as to the seed produced by the ordinary process of fecundation, and a new individual being in either instance equally produced. We are, therefore, led to speculate as to the final cause of the existence of sexual organs in plants, as well as in those lower animals which can be propagated by cuttings. One use, no doubt, may be the dissemination of the species; for many plants, if propagated by buds alone, would be in a manner confined to a single spot. Another secondary use is the production of fruits which afford the nourishment to animals. A third may be to minister to the gratification of the senses of man by the beauty of their forms and colours. But as these ends are only answered in a small proportion of cases, we must seek further for the uses of the organs in question; and hence the author suggested that they might have been provided, in order to prevent that uniformity in the aspect of Nature, which would have prevailed if plants had been multiplied exclusively by buds. It is well known that a bud is a mere counterpart of the stock from whence it springs, so that we are always sure of obtaining the very same description of fruit by merely grafting a bud or cutting of a pear or apple tree upon another plant of the same species. On the other hand, the seed never produces an individual exactly like the plant from which it sprang; and hence, by the union of the sexes in plants, some variation from the primitive type is sure to result. Dr. Daubeny remarked that if we adopt in any degree the views of Mr. Darwin with respect to the origin of species by natural selection, the creation of sexual organs in plants might be regarded as intended to promote this specific object. Whilst, however, he gave his assent to the Darwinian hypothesis, as likely to aid us in reducing the number of existing species, he wished not to be considered as advocating it to the extent to which the author seems disposed to carry it. He rather desired to recommend to naturalists the necessity of further inquiries, in order to fix the limits within which the doctrine pro-

posed by Mr. Darwin may assist us in distinguishing varieties from species.

Prof. Huxley, having been called on by the Chairman, deprecated any discussion on the general question of the truth of Mr. Darwin's theory. He felt that a general audience, in which sentiment would unduly interfere with intellect, was not the public before which such a discussion should be carried on. Dr. Daubeny had brought forth nothing new to demand or require remarrk.—Mr. R. Dowden, of Cork, mentioned, first, two instances in which plants had been disseminated by seeds, which could not be effected by buds; first, in the introduction of *Senecio squalida*, by the late Rev. W. Hincks; and, second, in the diffusion of chicory, in the vicinity of Cork, by the agency of its winged seeds. He related several anecdotes of a monkey, to show that however highly organized the Quadrumana might be, they were very inferior in intellectual qualities to the dog, the elephant and other animals. He particularly referred to his monkey being fond of playing with a hammer; but although he liked oysters as food, he never could teach him to break the oysters with his hammer as a means of indulging his appetite.—Dr. Wright stated that a friend of his, who had gone out to report on the habits of the gorilla—the highest form of monkey—had observed that the female gorilla took its young to the sea-shore for the purpose of feeding them on oysters, which they broke with great facility.—Prof. Owen wished to approach this subject in the spirit of the philosopher, and expressed his conviction that there were facts by which the public could come to some conclusion with regard to the probabilities of the truth of Mr. Darwin's theory. Whilst giving all praise to Mr. Darwin for the courage with which he had put forth his theory, he felt it must be tested by facts. As a contribution to the facts by which the theory must be tested, he would refer to the structure of the highest Quadrumana as compared with man. Taking the brain of the gorilla, it presented more differences, as compared with the brain of man, than it did when compared with the brains of the very lowest and most problematical form of the Quadrumana. The deficiencies in cerebral structure between the gorilla and man were immense. The posterior lobes of the cerebrum in man presented parts which were wholly absent in the gorilla. The same remarkable differences of structure were seen in other parts of the body; yet he would especially refer to the structure of the great toe in man, which was

constructed to enable him to assume the upright position; whilst in the lower monkeys it was impossible, from the structure of their feet, that they should do so. He concluded by urging on the physiologist the necessity of experiment. The chemist, when in doubt, decided his questions by experiment; and this was what was needed by the physiologist.—Prof. HUXLEY begged to be permitted to reply to Prof. Owen. He denied altogether that the difference between the brain of the gorilla and man was so great as represented by Prof. Owen, and appealed to the published dissections of Tiedemann and others. From the study of the structure of the brain of the Quadrumana, he maintained that the difference between man and the highest monkey was not so great as between the highest and the lowest monkey. He maintained also, with regard to the limbs, that there was more difference between the toeless monkeys and the gorilla than between the latter and man. He believed that the great feature which distinguished man from the monkey was the gift of speech.

On the Intellectual Development of Europe, considered with Reference to the Views of Mr. Darwin and others, that the Progression of Organisms is determined by Law, by Prof. DRAPER, M.D., of New York.—The object of this paper was to show that the advancement of man in civilization does not occur accidentally or in a fortuitous manner, but is determined by immutable law. The author introduced his subject by recalling proofs of the denomination of law in the three great lines of the manifestation of life. First, in the successive stages of development of every individual, from the earliest rudiment to maturity; secondly, in the numberless organic forms now living contemporaneously with us, and constituting the animal series; thirdly, in the orderly appearance of that grand succession which in the slow lapse of geological time has emerged, constituting the life of the Earth, showing therefrom not only the evidences, but also proofs of the dominion of law over the world of life. In these three lines of life he established that the general principle is to differentiate instinct from automatism, and then to differentiate intelligence from instinct. In man himself three distinct instrumental nervous mechanisms exist, and three distinct modes of life are perceptible, the automatic, the instinctive, the intelligent. They occur in an epochal order, from infancy through childhood to the more perfect state. Such holding good for the individual, it was then affirmed that it is physiologically impossible to separate

the individual from the race, and that what holds good for the one holds good for the other too; and hence that man is the archetype of society, and individual development the model of social progress, and that both are under the control of immutable law: that a parallel exists between individual and national life in this, that the production, life, and death of an organic particle in the person, answers to the production, life, and death of a person in the nation. Turning from these purely physiological considerations to historical proof, and selecting the only European nation which thus far has offered a complete and completed intellectual life, Prof. Draper showed, that the characteristics of Greek mental development answer perfectly to those of individual life, presenting philosophically five well-marked ages or periods,—the first being closed by the opening of Egypt to the Ionians; the second including the Ionian Pythagorean, and Eleatic philosophies, was ended by the criticisms of the Sophists; the third, embracing the Socratic and Platonic philosophies, was ended by the doubts of the Sceptics; the fourth, ushered in by the Macedonian expedition and adorned by the splendid achievements of the Alexandrian school, degenerated into Neoplatonism and imbecility in the fifth, to which the hand of Rome put an end. From the solution of the four great problems of Greek philosophy, given in each of these five stages of its life, he showed that it is possible to determine the law of the variation of Greek opinion, and to establish its analogy with that of the variations of opinion in individual life. Next, passing to the consideration of Europe in the aggregate, Prof. Draper showed that it has already in part repeated these phases in its intellectual life. Its first period closes with the spread of the power of Republican Rome, the second with the foundation of Constantinople, the third with the Turkish invasion of Europe: we are living in the fourth. Detailed proofs of the correspondence of these periods to those of Greek life, and through them to those of individual life, are given in a work now printing on this subject, by the author, in America. Having established this conclusion, Prof. Draper next briefly alluded to many collateral problems or inquiries. He showed that the advances of men are due to external and not to interior influences, and that in this respect a nation is like a seed, which can only develop when the conditions are favourable, and then only in a definite way; that the time for psychical change corresponds with that for physical,

and that a nation cannot advance except its material condition be touched,—this having been the case throughout all Europe, as is manifested by the diminution of the blue-eyed races thereof; that all organisms and even man are dependent for their characteristics, continuance, and life on the physical conditions under which they live; that the existing apparent invariability presented by the world of organization is the direct consequence of the physical equilibrium, but that if that should suffer modification, in an instant the fanciful doctrine of the immutability of species would be brought to its proper value. The organic world appears to be in repose because natural influences have reached an equilibrium. A marble may remain motionless for ever on a level table, but let the table be a little inclined, and the marble will quickly run ofl; and so it is with organisms in the world. From his work on Physiology, published in 1856, he gave his views in support of the doctrine of the transmutation of species; the transitional forms of the animal and also the human type; the production of new ethnical elements, or nations; and the laws of their origin, duration, and death.

The announcement of this paper attracted an immense audience to the Section, which met this morning in the Library of the New Museum. The discussion was commeneed by the Rev. Mr. Cresswell, who denied that any parallel could be drawn between the intellectual progress of man and the physical development of the lower animals. So far from the author being correct with regard to the history of Greece, its masterpieces in literature—the Iliad and Odyssey—were produced during its national infancy. The theory of intellectual development proposed was directly opposed to the known facts of the history of man.—Sir B. Brodie stated, he could not subscribe to the hypothesis of Mr. Darwin. His primordial germ had not been demonstrated to have existed. Man had a power of self-consciousness—a principle differing from anything found in the material world, and he did not see how this could originate in lower organisms This power of man was identical with the Divine Intelligence; and to suppose that this could originate with matter, involved the absurdity of supposing the source of Divine power dependent on the arrangement of matter. The Bishop of Oxford stated that the Darwinian theory, when tried by the principles of inductive science, broke down. The facts brought forward did not warrant the theory. The permanence of specific forms was a fact con-

firmed by all observation. The remains of animals, plants, and man found in those earliest records of the human race—the Egyptian catacombs, all spoke of their identity with existing forms, and of the irresistible tendency of organized beings to assume an unalterable character. The line between man and the lower animals was distinct: there was no tendency on the part of the lower animals to become the self-conscious intelligent being, man; or in man to degenerate and lose the high characteristics of his mind and intelligence. All experiments had failed to show any tendency in one animal to assume the form of the other. In the great case of the pigeons quoted by Mr. Darwin, he admitted that no sooner were these animals set free than they returned to their primitive type. Everywhere sterility attended hybridism, as was seen in the closely-allied forms of the horse and the ass. Mr. Darwin's conclusions were an hypothesis, raised most unphilosophically to the dignity of a causal theory. He was glad to know that the greatest names in science were opposed to this theory which he believed to be opposed to the interests of science and humanity.—Prof. HUXLEY defended Mr. Darwin's theory from the charge of its being merely an hypothesis. He said, it was an explanation of phenomena in Natural History, as the undulating theory was of the phenomena of light. No one objected to that theory because an undulation of light had never been arrested and measured. Darwin's theory was an explanation of facts; and his book was full of new facts, all bearing on his theory. Without asserting that every part of the theory had been confirmed, he maintained that it was the best explanation of the origin of species which had yet been offered. With regard to the psychological distinction between man and animals; man himself was once a monad—a mere atom, and no body could say at what moment in the history of his development he became consciously intelligent. The question was not so much one of a transmutation or transition of species, as of the production of forms which became permanent. Thus the short-legged sheep of America were not produced gradually, but originated in the birth of an original parent of the whole stock, which had been kept up by a rigid system of artificial selection.—Admiral FITZROY regretted the publication of Mr. Darwin's book, and denied Prof. Huxley's statement, that it was a logical arrangement of facts.—Dr. BEALE pointed out some of the difficulties with which the Darwinian theory had to deal, more espe-

cially those vital tendencies of allied agents.—Mr. Lubbock expressed his willingness to accept the Darwinian hypothesis in the absence of any better. He would, however, express his conviction, that time was not an essential element in these changes. Time alone produce no change.—Dr. Hooker, being called upon by the President to state his views of the botanical aspect of the question, observed, that the Bishop of Oxford having asserted that all men of science were hostile to Mr. Darwin's hypothesis, —whereas he himself was favourable to it,—he could not presume to address the audience as a scientific authority. As, however, he had been asked for his opinion, he would briefly give it. In the first place, his Lordship, in his eloquent address, had, as it appeared to him, completely misunderstood Mr. Darwin's hypothesis: his Lordship intimated that this maintained the doctrine of the transmutation of existing species one into another, and had confounded this with that of the successive development of pescies by variation and natural selection. The first of these doctrines was so wholly opposed to the facts, reasonings, and results of Mr. Darwin's work, that he could not conceive how any one who had read it could make such a mistake,—the whole book, indeed, being a protest against that doctrine. Then, again, with regard to the general phenomena of species, he understood his Lordship to affirm that these did not present characters that should lead careful and philosophical naturalists to favour Mr. Darwin's views. To this assertion Dr. Hooker's experience of the Vegetable Kingdom was diametrically opposed. He considered that at least one half of the known kinds of plants were disposable in groups, of which the species were connected by varying characters common to all in that group, and sensibly differing in some individuals only of each species; so much so that, if each group be likened to a cobweb, and one species be supposed to stand in the centre of that web, its varying characters might be compared to the radiating and concentric threads, when the other species would be represented by the points of union of these; in short, that the general characteristic of orders, genera, and species amongst plants differred in degrees only from those of varieties, and afforded the strongest countenance to Mr. Darwin's hypothesis. As regarded his own acceptation of Mr. Darwin's views, he expressly disavowed having adopted them as a creed. He knew no creeds in scientific matters. He had early begun the study of natural science under the idea that species

were original creations; and it should be steadily kept in view that this was merely another hypothesis, which in the abstract was neither more nor less entitled to acceptance than Mr. Darwin's: neither was, in the present state of science, capable of demonstration, and each must be tested by its power of explaining the mutual dependence of the phenomena of life. For many years he had held to the old hypothesis, having no better established one to adopt, though the progress of botany had, in the interim, developed no new facts that favoured it, but a host of most suggestive objections to it. On the other hand, having fifteen years ago been privately made acquainted with Mr. Darwin's views, he had during that period applied these to botanical investigations of all kinds in the most distant parts of the globe, as well as to the study of some of the largest and most different Floras at home. Now, then, that Mr. Darwin had published it, he had no hesitation in publicly adopting his hypothesis, as that which offers by far the most probable explanation of all the phenomena presented by the classification, distribution, structure, and development of plants in a state of nature and under cultivation; and he should, therefore, continue to use his hypothesis as the best weapon for future research, holding himself ready to lay it down should a better be forthcoming, or should the now abandoned doctrine of original creations regain all it had lost in his experience.

Review of Proceedings.

Fairbairn President! These two words announce the story of the British Association for the year to come. Manchester being the place selected for the meeting of 1861, it has been thought both just and gracious that the honours of the chair should be given to a representative man of that great city. How rapid and how democratic is the movement of English life! Mr. Fairbairn was a grown man at a time when Manchester was scarcely known south of the Trent save as a town of cotton, just as Dunstable may have been known as a town of straw; when it had no representative in the House of Commons, and scarcely any representatives in the republic of science. Yet he has lived not only to see its political representatives among the first in influence at Westminster; its scientific representatives seated among the highest in all learned societies; its social and commercial representatives, its mayor and aldermen, received with distinction in

the most exclusive and aristocratic city of the empire; and himself chosen by the most illustrious men of this nation, assembled in the classic halls of Oxford, to succeed to a dignity vacated within the past week by the august Consort of the Queen. How different from the day when Dalton first intimated to the world without, that Manchester was not a mere cotton ball! The whole world of science will ratify the choice of Mr. Fairbairn for the Presidential chair.

The week which began with the Prince's speech, and which has closed, under the auspices of Lord Wrottesley, with the nomination of Mr. Fairbairn, has been eminently useful, various and agreeable. Since Friday, the air has been soft, the sky sunny. A sense of sudden summer has been felt in the meadows of Christ Church and in the gardens of St. John's; many a dreamer of dreams, tempted by the summer warmth, has followed the Cadiz proverb, and stealing from section A or B, has consulted his ease and taken a boat. To say that the meeting has been held in Oxford, is to say that it has been held in the midst of objects of the highest human interest and of the most delightful associations—in a city of students and professors—within reach of libraries, museums, philosophical instruments, observatories, collections of natural history, such as no other provincial city in England,—or in Europe,—can boast. The hospitality has been limitless. The colleges, the private houses, have been full. The splendid and piquant New Museum, has been open day and night. An unusual flutter of silk and muslin has warmed with a brighter glow the old caves of the Bodleian. Groups that Watteau would have loved to paint have been daily seen under the elms of the Broad Walk or in the shades of Magdalen. Exeter chapel, which Mr. Scott has transformed into the likeness of the Sainte Chapelle in Paris, has had its hosts of pilgrims. Every morning has brought its charming breakfast parties, every evening its charming early dinners, closed by its no less charming receptions. A splendid lecture has been given by Prof. Walker on the present state of our knowledge of the Sun; two admirable sermons have been preached at St. Mary's by Mr. Temple and Mr. Mansell, on the Religious Aspects of Science; and on Saturday night, when there was no reception at the New Museum, Dr. Daubeny received a select portion of the *savans* of both sexes in his tent at the Botanic Gardens. A batch of new Doctors of Civil Law has been added to the illustrious roll, amongst whom Prof. Sedgwick was the un

questionable lion of the day. Talking of lions reminds us that the Red Lions have had their annual feed; this time under the presidency of Prof. Huxley. There have been excursions numberless; the students of Geology riding chiefly to Shotover; the lovers of Art chiefly to Blenheim. The Duke of Marlborough has paid the members of the British Association the delicate compliment of throwing open his noble grounds and galleries at the hours most convenient for their visits, and in cases where proper applications have been made, of allowing the treasures of his private apartments to be inspected in the most liberal manner. Hundreds have accepted His Grace's generous invitation to Blenheim, where the grounds are in perfect beauty, and the glorious Raffaelles, Rubens', and Van Dycks have recently been arranged and noted by the accomplished hand of Mr. Scharf.

Yet the main interest of the week has unquestionably centred in the Sections, where the intellectual activities have sometimes breathed over the courtesies of life like a sou'-wester, cresting the waves of conversation with white and brilliant foam. The flash, and play, and collisions in these Sections have been as interesting and amusing to the audiences as the Battle at Farnborough or the Volunteer Review to the general British public. The Bishop of Oxford has been famous in these intellectual contests, but Dr. Whewell, Lord Talbot de Malahide, Prof. Sedgwick, Mr. Crawford, and Prof. Huxley have each found foemen worthy of their steel, and made their charges and countercharges very much to their own satisfaction and the delight of their respective friends. The chief cause of contention has been the new theory of the Development of Species by Natural selection—a theory open—like the Zoological Gardens (from a particular cage in which it draws so many laughable illustrations)—to a good deal of personal quizzing, without, however, seriously crippling the usefulness of the physiological investigations on which it rests. The Bishop of Oxford came out strongly against a theory which holds it possible that man may be descended from an ape,—in which protest he is sustained by Prof. Owen, Sir Benjamin Brodie, Dr. Daubeny, and the most eminent naturalists assembled at Oxford. But others conspicuous among these, Prof. Huxley—have expressed their willingness to accept, for themselves, as well as for their friends and enemies, all actual truths, even the last humiliating truth of a pedigree not registered in the Herald's College. The dispute has at least made Oxford uncommonly lively during the week.

NATURAL HISTORY SOCIETY'S ROOMS.

Montreal, November 5th, 1860.

The Society held its usual monthly meeting. The President, the Lord Bishop of Montreal, in the Chair.

The Minutes of last meeting and the report of the Council were read and adopted, several new members were balloted for, and others proposed.

The following donations were presented :—

From Geo. Barnston, Esq., Michipicoton.

A pair of Black Ducks.—(*Anas obscura*).
An Eared Greel.—(*Podiceps auritus*).
A Marsh Harrier.—(*Circus cyanus*).
A Wilson's Snipe.—(*Fringa Wilsonii*).
A Falcon.—(*Falco anatina.*)

From Mr. Cunninghame.

Specimens of Copper Ore from Acton.

From Mr. Blackwell.

A fine Bust of the late Dr. Buckland.

The thanks of the Society were voted to the donors.

Thereafter it was resolved, viz: That on occasion of the decease of the late Andrew F. Holmes, M.D., L.L.D., this society desires to record its high appreciation of his personal and scientific character, and its gratitude for his services as a pioneer of Natural Science in Canada, and more especially as one of the founders of this Society, a zealous promoter of its interests in its earlier years, and an important contributor to its collections.

And that in testimony of respect for the deceased and sympathy with his surviving relatives, a copy of this resolution be transmitted by the corresponding secretary to Mrs. Holmes.

The ordinary business having been finished, and a large number of members being assembled in the Library, the President called upon Principal Dawson to read a paper "On the recent Earthquake with notices of previous Earthquakes in Canada." This paper was of much interest, and will be found among the articles of this number of the *Naturalist;* it elicited an animated discussion.

From the report of the Committee on Lectures, and papers for the monthly meetings, it appears that this winter there will be a succession of scientific subjects of a novel and instructive kind brought before the Society.

The next meeting will be held on Monday evening, December 3.

MONTHLY METEOROLOGICAL REGISTER, ST. MARTINS, ISLE JESUS, CANADA EAST, (NINE MILES WEST OF MONTREAL,) FOR THE MONTH OF AUGUST, 1860.

Latitude, 45 degrees 32 minutes North. Longitude, 73 degrees 36 minutes West. Height above the level of the Sea, 118 feet.

BY CHARLES SMALLWOOD, M.D., LL.D.

Day of Month.	Barometer—corrected and reduced to 32° F. (English inches.)			Temperature of the Air.—F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.			Direction of Wind.			Horizontal Movement in 24 hours. In miles.	OZONE. Mean amount of, in inches.	RAIN. Amount of, in inches.	SNOW. Amount of, in inches.	WEATHER, CLOUDS, REMARKS, &c. &c. [A cloudy sky is represented by 10, a cloudless one by 0.]		
	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.					6 a. m.	2 p. m.	10 p. m.
1	29.854	29.820	29.954	50.0	68.8	59.2	.258	.319	.352	.71	.47	.70	W.	W. S. W.	S. W. by S.	166.90	2.5	....	....	Clear.	Clear.	Clear.
2	972	859	990	52.5	80.6	66.0	.282	.445	.407	.74	.43	.63	S. W.	S. W.	S. W.	4.80	1.0	....	....	"	Cumb. 2.	Cir. 2.
3	907	783	851	56.0	88.2	77.0	.315	.530	.639	.71	.40	.69	E. by S.	S. S. E.	W. by S.	80.20	1.0	....	....	" Heavy Dew.	Clear.	Cu. Str. 9.
4	717	741	705	73.0	85.6	70.2	.725	.603	.523	.88	.49	.72	S. W. by W.	W. by S	N. W.	113.40	2.0	0.487	....	Cu. Str. 8.	Cu. Str. 0.	Str. 2. Aurora Borealis.
5	809	811	900	68.0	83.5	67.8	.393	.597	.489	.59	.53	.75	N. E.	W.	W. by S.	110.60	1.5	....	....	Clear.	Clear.	Clear. Aurora Borealis.
6	904	809	785	64.3	93.2	72.4	.464	.710	.559	.77	.46	.72	S. by W.	S. S. W.	S. W.	13.80	1.0	....	....	"	"	Cu. Str. 6.
7	705	583	604	70.3	90.2	75.2	.551	.699	.745	.75	.64	.86	S. by E.	W.	N. N. W.	41.70	0.5	....	....	"	Hazy.	" 9. dist. th. vivid lt'ng.
8	720	616	594	71.1	87.2	73.2	.572	.664	.728	.76	.52	.79	W. by S.	W.	S. by W.	39.40	2.5	....	....	"	Clear.	Str. 2. Aurora Borealis.
9	585	614	708	73.2	79.0	65.8	.393	.574	.516	.85	.58	.84	S. S. W.	S. S. W.	S. by W.	63.50	2.5	0.300	....	"	Cu. Str. 8. thuud.	Clear. " "
10	699	608	701	64.2	92.2	68.0	.464	.556	.437	.77	.57	.63	S. S. W.	S. by W.	W.	32.60	2.0	....	....	"	" 2.	C. Str. 9. Lightning.
11	851	907	957	54.1	83.2	54.5	.335	.558	.355	.80	.50	.80	N.	N. E. by E.	S. by E.	59.30	2.5	Inapp.	....	Cu. Str. 10.	Clear.	Clear. Aurora Borealis.
12	824	780	811	46.1	80.9	66.2	.262	.624	.502	.84	.59	.78	S. E. by E.	S.	S. S. W.	60.70	1.0	....	....	Fog.	"	" " "
13	441	146	735	63.8	65.0	60.8	.543	.583	.462	.94	.94	.91	S. ty E.	N. E.	W. N. W.	59.40	4.0	0.929	....	Rain.	Rain.	Cu. St. 9.
14	914	911	952	53.6	66.9	56.7	.376	.463	.420	.88	.71	.94	W.	S. W.	S. W.	36.50	2.5	0.011	....	Cu. Str. 8.	Cu. Str. 6.	" 9.
15	995	30.070	80.057	64.5	72.0	64.2	.328	.397	.464	.77	.52	.76	W. by N.	N. by W.	W. by S.	149.40	1.5	....	....	" 6.	Clear.	Clear.
16	30.018	29.880	29.960	50.1	78.6	63.9	.250	.443	.503	.71	.46	.86	W. S. W.	S. W.	S. S. W.	82.30	1.0	....	....	Clear Heavy Dew.	St. 2.	Cu. St. 2. Aurora Borealis.
17	29.867	740	711	61.4	85.0	67.3	.466	.507	.489	.85	.43	.75	W. S W.	W. S. W.	S. S. W.	116.90	1.0	....	....	" " "	Clear.	Clear.
18	751	571	719	62.9	70.6	63.7	.517	.651	.536	.91	.88	.92	W. S. W.	S. S. W.	W. N. W.	55.10	3.0	0.900	....	Nimb. 9.	Rain.	C. Str. 4. " "
19	814	794	880	61.7	79.7	68.4	.466	.612	.443	.85	.62	.65	E. by N.	S. E.	S. E. by E.	134.39	2.0	....	....	Cu. Str. 8.	Cu. Str. 4.	" 6.
20	826	766	851	67.6	77.4	68.9	.626	.705	.671	.95	.81	.96	S. S. E.	S. S. E.	S. S. W.	174.71	3.0	0.430	....	Rain.	" 9.	Clear.
21	799	857	861	67.3	83.0	67.0	.598	.565	.591	.92	.57	.89	S. S. W.	S. W.	S.	101.20	2.5	0.230	....	Cu. Str. 8.	" 2.	" " "
22	857	834	918	62.3	83.7	67.2	.523	.514	.571	.94	.45	.50	S. by W.	S. W.	S. S. W.	54.20	3.0	....	....	" 10.	Cumb. 2.	" " "
23	876	803	824	65.6	86.2	72.2	.362	.511	.566	.87	.41	.74	S. S. W.	N. E. by E.	N. N. E.	90.60	2.5	....	....	Clear. Heavy Dew.	Clear.	Rain.
24	874	711	735	64.2	68.8	66.1	.576	.642	.604	.92	.92	.94	S. E. by E.	S. by E.	S. by E.	136.00	3.0	4.095	....	Rain. Dist. thunder.	Cu. Str. 10.	Cu. Str. 8.
25	606	484	526	65.0	77.6	62.1	.618	.678	.498	1.00	.73	.91	S.	S. S. E.	W. by S.	72.80	4.0	0.500	....	Cu. 4.	" 8.	" 6. Lunar Rainbow
26	534	600	711	62.3	75.8	63.0	.530	.590	.422	.97	.68	.75	W.	N. W.	W.	251.60	3.0	....	....	" Str. 8.	Clear.	Clear.
27	682	621	646	52.2	75.6	57.3	.361	.476	.407	.94	.59	.87	S. S. E.	W.	S. W.	71.80	2.0	0.453	....	Clear.	Cu. St. 8.	Cu. Str. 6.
28	634	666	692	53.9	61.4	57.3	.396	.583	.378	.96	.71	.81	S. S. W.	S. W.	S. W.	199.50	1.5	0.181	....	Cu. Str. 4.	Slight Rain.	" 4.
29	733	715	809	55.5	76.4	59.2	.298	.541	.439	.90	.60	.88	S. W.	S. W.	S. W.	181.50	1.5	Inapp.	....	" 6.	Showers.	Clear.
30	755	568	459	54.4	78.9	65.0	.390	.564	.420	.94	.61	.68	S. W.	W. by S.	S. W.	157.30	1.5	....	....	Clear.	Clear.	"
31	468	480	514	56.1	72.1	60.2	.391	.600	.456	.87	.78	.88	S. W.	W. N. W.	W, by N.	138.10	2.5	0.070	....	Cu. Str. 10.	Cu. St. 4.	Cirr. Str. 2.

REPORT FOR THE MONTH OF SEPTEMBER, 1860.

Day of Month.	Barometer—corrected and reduced to 32° F. (English inches.)			Temperature of the Air.—F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.			Direction of Wind.			Horizontal Movement in 24 hours. In miles.	OZONE. Mean amount of	RAIN. Amount of, in inches.	SNOW. Amount of, in inches.	WEATHER, CLOUDS, REMARKS, &c. &c. [A cloudy sky is represented by 10, a cloudless one by 0.]		
	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a.m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.					6 a. m.	2. p. m.	10 p. m.
1	29.748	29.786	29.833	53.0	70.1	50.5	.380	.397	.283	.94	.52	.78	N. N. W.	W. by N.	N. W.	41.19	2.0	....	....	Clear.	Clear.	Cu. St. 2.
2	916	944	30.073	45.6	64.6	53.9	.280	.246	.370	.88	.42	.84	W. by N.	N. W.	W. by S.	0.00	2.0	....	....	"	C. C. Str. 4.	Clear.
3	30.212	30.208	130	42.9	72.3	59.2	.237	.263	.358	.77	.31	.73	W. N. W.	W. by N.	W. S. W.	98.60	2.0	....	....	Slight frost.	Clear.	"
4	114	037	29.974	41.0	83.4	67.7	.258	.630	.550	.88	.54	.82	S. S E.	S. W.	S. W.	45.40	1.5	....	....	Clear.	Cir. Str. 4.	Cu. Str. 8.
5	29.916	29.804	843	66.2	82.3	70.2	.604	.650	.621	.94	.59	.84	S. E.	W. by S.	W. by S.	128.10	3.5	0.300	....	Rain.	Clear.	Clear.
6	839	845	957	63.3	80.3	59.7	.536	.599	.380	.92	.59	.76	W. by S.	W. S. W.	W. by S.	17.20	2.0	....	....	Cirr. Str. 4.	"	" Aurora Borealis.
7	918	812	752	63.5	81.4	69.9	.369	.585	.829	.90	.56	.75	S. W.	S. W.	S. W.	162.00	2.5	....	....	Clear.	"	C. C. Str. 9.
8	935	941	947	51.3	58.0	44.2	.368	.336	.224	.96	.72	.79	N. E. by E.	N. by E.	N. by W.	223.10	2.5	....	....	Cu. Str. 8.	Cu. Str. 9.	Clear.
9	998	960	993	48.5	62.6	48.0	.285	.370	.251	.85	.66	.74	N. E. by E.	N. by E.	N: W.	123.40	1.0	....	....	Clear.	" 6.	"
10	902	783	307	48.6	64.2	55.0	.214	.403	.328	.95	.67	.77	W. by S.	W. by S.	W. by S.	103.70	1.0	....	....	Slight frost.	" 8.	Cu. Str. 9. Aurora Borealis.
11	802	701	677	35.9	64.4	53.0	.293	.403	.375	.96	.67	.93	W. S. W.	W. S. W.	S. E.	62.00	2.5	0.800	....	Clear heavy dew,.	" 10.	Rain.
12	699	726	747	45.6	44.8	46.3	.297	.275	.293	.98	.92	.96	N. E. by E.	N. N. E.	N.	227.10	3.5	2.466	....	Rain.	Rain.	Cu. Str. 9.
13	800	889	770	47.3	71.4	55.0	.199	.371	.341	.90	.49	.83	N. by W.	W. by N.	W. by S.	254.30	1.5	....	....	Clear.	Clear.	Clear.
14	30.094	30.099	30.100	37.1	71.7	62.0	.298	.397	.485	.92	.52	.86	W. by S.	W. by S.	W. by S.	104.20	2.0	....	....	"	"	"
15	107	017	29.970	47.4	81.9	66.7	.273	.617	.496	.85	.58	.77	W. by S.	W. by S.	S. W.	50.00	2.5	....	....	"	"	" Aurora Borealis.
16	29.970	29.916	876	42.0	70.1	65.1	.492	.516	.549	.79	.70	.89	S. W.	S. S. W.	S. W.	1.00	2.0	Inapp.	....	C. Str. 6.	C. Str. 10.	C. Str. 10.
17	760	815	897	62.8	72.3	62.2	.549	.489	.429	.97	.62	.77	S. S. W.	W.	S. W.	166.20	1.5	0.300	....	" 8.	" 4.	" 9. Aurora Borealis.
18	949	946	962	67.0	80.1	65.0	.291	.638	.420	.89	.62	.68	S. W.	S. S. W.	S. E. by E.	27.80	2.0	....	....	Fog.	Clear.	Clear.
19	860	853	871	42.0	73.0	63.8	.368	.614	.556	.95	.68	.92	S. E. by E.	S. E. by E.	S. S. E.	6.60	2.0	Inapp.	....	Clear.	Cu. Str. 6.	" Aurora Borealis.
20	679	642	596	51.7	69.3	65.0	.321	.678	.849	.87	.97	.80	S. S. E.	S. S. E.	W.	261.30	3.0	0.640	....	Cu. Str. 10.	Rain.	Cu. Str. 4.
21	498	566	790	52.3	63.9	48.3	.334	.422	.326	.86	.75	.70	W. S. W.	W. S. W.	S. W.	138.90	2.0	0.600	....	" 10.	Cu. Str. 6.	Clear.
22	854	725	863	42.0	61.4	54.6	.251	.413	.390	.96	.77	.93	S. W.	S. E.	W. S. W.	118.11	4.5	0.400	....	Clear.	" 2.	Cu. Str. 9.
23	963	30.017	999	39.7	60.0	47.2	.225	.242	.256	.91	.48	.81	S. W. by W.	S. S. W.	S. E.	46.00	2.0	....	....	"	Clear.	Clear.
24	712	29.609	654	54.8	76.3	61.2	.355	.548	.473	.84	.62	.88	S. S. E.	S. E.	S. E. by E.	302.40	2.0	1.300	....	C. Cu. Str. 6.	Cu. C. Str. 2.	Cu. Str. 10. Thunder.
25	467	376	438	86.0	62.8	51.0	.413	.453	.341	.90	.80	.89	S. S. E.	W. S. W.	W. S. W.	264.80	3.5	3.643	....	C. Str. 9.	" 4.	" 8.
26	584	738	889	49.0	52.9	44.8	.292	.302	.234	.82	.76	.80	W. S. W.	W. S. W.	W.	397.80	2.5	0.400	....	" 8.	C. Str. 2.	" 8.
27	30.045	975	979	33.7	49.7	41.8	.162	.223	.228	.84	.64	.87	W.	W. S. W.	S. W.	316.04	2.0	....	....	Clear frost.	" 2.	C. C. Str. 6.
28	29.667	940	30.225	39.7	47.0	34.2	.210	2.80	.170	.86	.88	.87	N. by W.	N. W.	W. by N.	77.60	3.0	0.437	....	Cu. Str. 10.	" 8.	C. C. Str. 6. Thunder & light'g.
29	30.106	30.155	224	31.6	44.2	34.2	.149	.196	.155	.84	.68	.79	W. S. W.	W. by S.	N.W. by W.	225.40	1.5	....	....	Clear frost.	" 10.	C. Str. 10.
30	317	324	335	31.0	48.4	34.0	.130	.236	.175	.74	.70	.89	W. S. W.	W. S. W.	S.	48.00	2.0	....	....	" "	Clear.	Clear.
...	......	......	......	......	......	......	......	......	......	......	......	......	....	....	....	....	......			....	....	....

REMARKS FOR AUGUST, 1860.

Barometer...... { Highest, the 15th day, 30·070 inches. Lowest, the 30th day, 29.459 ". Monthly Mean, 29.760 ". " Range, 0.611 ". }

Thermometer... { Highest, the 10th day, 92°2. Lowest, the 12th day, 39°2. Monthly Mean, 60°29. Monthly Range, 52°9. }

Greatest intensity of the Sun's rays, 110°6.
Lowest point of Terrestrial radiation, 31°1.
Amount of Evaporation, 3.02 inches.
Mean of Humidity, .740.
Rain fell on 13 days, amounting to 9.361 inches; it was raining 51 hours and 44 minutes, and was accompanied by thunder and lightning on 2 days.

Meteor in E. 5th day at 8.45 p. m.
Meteor in S. 12th day at 8·30 p. m.
Solar Rainbow 19th day.
Lunar Rainbow at 8 p.m. 25th day.
Most prevalent wind, the S. W.
Least prevalent wind, the S.
Most windy day, the 26th day; mean miles per hour, 10.70.
Least windy day, the 2nd day; mean miles per hour, 0.20.
Aurora Borealis visible on 10 nights.
The Electrical state of the Atmosphere has indicated high intensity.
Solar Halo visible on 16th day at 9.30 a. m.
Slight frost on the morning of the 12th day

REMARKS FOR SEPTEMBER, 1860.

Barometer. ...... { Highest, the 30th day, 30.335 inches. Lowest, the 25th day, 29.376 ". Monthly Mean, 29.885 ". Monthly Range, 0.450 ". }

Thermometer. { Highest, the 15th day, 83°9. Lowest, the 30th day, 25°5. Monthly Mean, 56°40. Monthly Range, 27°5. }

Greatest intensity of the Sun's rays, 105°6.
Lowest point of terrestrial radiation, 20°1.
Amount of Evaporation, 2·90 inches.
Mean of humidity, .777.
Rain fell on 13 days, amounting to 11.286 inches; it was raining 58 hours 36 minutes, and was accompanied by thunder and lightning on two days.

Solar Halo 14th day.
Lunar Corona and imperfect Halo 27th day.
Very slight snow fell on the 29th day. Inappreciable the 1st of the season.
Sharp frost on the mornings of the 29th and 30th days.
Morning Rainbow on the 20th day.
Most prevalent wind, the W. S. W.
Least prevalent wind, the N.
Most windy day, the 26th day; mean miles per hour, 18.86.
Least windy day, the 2nd day; mean miles per hour 0.00.
Aurora Borealis visible on 5 nights.
The Electrical state of the Atmosphere has indicated moderate intensity.

THE

CANADIAN

NATURALIST AND GEOLOGIST.

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ARTICLE XLIX.—*On certain theories of the formation of mountains.*

No. 1.

The causes of the elevation of mountains above the general contour of the earth whether in the shape of isolated peaks or continuous chains have always been favourite subjects for speculation among physical geologists. In Europe the Alps situated as they are in the very centre of the cradle of civilisation have naturally received the greatest amount of consideration, while in America the origin of the long ranges of the Appalachians has been, ever since the dawn of science upon this continent, the all important problem to be solved. It is principally upon the theories of the elevation of these last mentioned mountains that we shall in this paper make a few observations.

The Appalachian system occupies a belt of mountainous country extending from Cape Gaspé, at the mouth of the St. Lawrence, south-westerly, through eastern Canada to the Province line near Lake Champlain where it enters the State of Vermont and is then continued in the same general direction to the State of Alabama. The total length of the belt is more than one thousand miles and its width from thirty to one hundred and fifty. It consists not o a single line of peaks but of numerous long parallel ridges separ-

ated from each other by valleys of variable width and depth. The height of these hills may be stated in a general way as ranging from five hundred to five thousand feet above the level of the sea. They attain their greatest developement in the States of Pennsylvania, Virginia, North Carolina and Tennessee where they have been most successfully studied by the brothers Professors W. B. and H. D. Rogers. The results of the observations of these two eminent geologists are given in a masterly paper read before the American Association for the Advancement of Science in 1842 and recently in a more matured form by H. D. Rogers in his magnificent work on the geology of Pennsylvania.

According to Professor Rogers the Appalachians consist nearly altogether of stratified rocks of palæozoic age including all the American formation from the base of the Silurian up to the top of the carboniferous. These rocks were deposited in nearly horizontal strata on a sea bottom, which in the region now occupied by the mountains in question, kept constantly subsiding during the whole period of their accumulation. South-east there existed in the place of the present Atlantic Ocean a vast continent from the waste of whose shores the material out of which the strata were formed was derived. In consequence of their proximity to the shore the formations on the south-east accumulated more rapidly than they did towards the south-west. For this reason there is now found a much greater thickness of the same rocks in Pennsylvania, Virginia, and other north eastern States than in those which lie further west such as Ohio, Indiana, Illinois and Iowa. The strata remained in their nearly horizontal position, perhaps sloping gently towards the south-west, until the close of the Carboniferous era. Then by some great disturbance of the equilibrium of the forces of nature they were thrown into a series of vast wave like undulations. The profile of these waves immediately after their elevation must have been somewhat similar to the following figure.

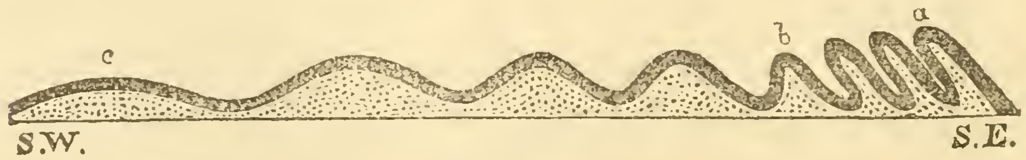


Fig. 1.

Fig. 1.—Ideal section across the Appalachians. The dotted space is intended to represent the rock of the original bottom of the ocean. The black undulated line represents the stratified rocks after having been

plicated or folded by the force, whatever it may have been, which elevated the mountains. The three folds on the right, marked *a*, are of the type of these that Prof. Rogers calls *Folded flexures*; *b*, is an example of a *Normal flexure*—steeper on one side than on the other; *c*, is a *Symmetrical flexure*, or one which slopes equally in both directions. The hollows are generally called by geologists *synclinal axes* and the ridges *anticlinal axes*.

Prof. Rogers shows that on the south western side of that part of the disturbed region now occupied by the western States the flexures are broad, flat swells not sufficiently abrupt or elevated to constitute mountain chains. But proceeding south easterly or towards the present Atlantic ocean they become more and more lofty and more closely crowded together. The western undulations are symmetrical, that is to say, they exhibit an equal slope on both sides but towards the east they gradually become steeper on one side—then vertical and even overhanging or overthrown. The steep sides are always towards the west and the overthrows are also all in the same direction.

The question to be answered is: what caused this wonderful folding up of the earth's crust? But before proceeding to give an account of the various solutions of the problem that have been proposed, we may state for the benefit of the non-geological reader that although at the present day these mountains consist of long parallel ridges they are not always the original ones. In the process of curvation the strata must have been fractured along the crest of each wave, and the rocks being thus broken up rendered more easily operated upon by atmospheric or aqueous agencies or by the action of both combined than those which formed the bottoms of the valleys. In many instances it can be shown that in consequence of the enormous denudation to which they have been subjected the original mountains have been completely worn away down to their very bases; and further that many of the finest and most fruitful valleys of the South are scooped out of the foundations of the ancient hills. On the other hand the bottoms of the hollows not having been so much fissured have been enabled to withstand the wear and tear of nature's forces until at length they constitute the crests of the ridges of the present day. We have thus mountains where once there were valleys and we have also valleys where of old, the mountains stood. The general aspect of the whole region has been so much changed during the long ages that have passed away since

its upheaval that the inexperienced observer may well fail to detect many indications of the systematic regularity represented in the above figure. Yet there remain sufficient of the original foldings of the strata to enable the physical geologist to demonstrate that Roger's elucidation of the structure is upon the whole correct.

The following are the principal theories of the origin of the flexures of the Appalachian Mountains.

Prof. Roger's Theory.

"The wave-like structure of the Appalachians and other undulated zones has been attributed by the author and his brother, Prof. W. B. Rogers, in their communications to the American Association in 1842, and to the British Association in the same year, to an actual undulation of the supposed flexible crust of the earth, exerted in parallel lines, and propagated in the manner of a horizontal pulsation from the liquid interior of the globe. We suppose the strata of such a region to have been subjected to excessive upward tension, arising from the expansion of molten matter and gaseous vapours, the tension relieved by linear fissures, through which much elastic vapour escaped, the sudden release of pressure adjacent to the lines of fracture producing violent pulsations on the surface of the liquid below. This oscillating movement in the fluid mass beneath would communicate a series of temporary flexures to the overlying crust, and these flexures would be rendered permanent (or keyed into the forms they present) by the intrusion of molten matter. If during this oscillation we conceive the whole heaving tract to have been shoved (or floated) bodily forward in the direction of the advancing waves, the union of this tangential with the vertical wave like movement will explain the peculiar steepening of the front side of each flexure, while a repetition of similar operations will account for the folding under or inversion, visible in the more compressed districts. We think that no purely upward or vertical forces exerted either simultaneously or successively along parallel lines, could produce a series of symmetrical flexures, and that a tangential pressure, unaccompanied by a vertical force, would result only in an imperceptible bulging of the whole region, or an irregular plication dependent on local inequalities in the amount of resistance. The alternate upward and downward movement necessary to enable a tangential force to bend the strata into a series of regular parallel subsiding flexures has been we conceive, of the nature of a

pulsation, such as would arise from a succession of actual waves rolling in a given direction beneath the earth's crust. It is difficult to account for the phenomena by any hypothesis of a gradual prolonged pressure exerted either vertically or horizontally. And, further, the formation of the grand yet simple flexures so frequently met with cannot be explained by a *repetition* of feeble, tangential movements, since these could not successively accord either in their direction or in their amount; nor can it by a repetition of merely vertical pressures, for it is impossible to suppose that these could without some undulating action, shift their positions through a series of symmetrically disposed parallel lines. We find it equally impossible to understand how, if feeble and often repeated, these vertical pressures should always return to the same lines to produce the conspicuous flexures we behold. The oscillations of the crust to which the undulations of the strata are attributed have been, we conceive, of the nature of the earthquakes of the present day. Earthquakes consist, as we think we have demonstrated, of a true pulsation of the flexible crust of the globe, propelled in parallel low waves of great length and amplitude with prodigious velocity, from lines of fracture, either conspicuous volcanic axes or half-concealed deep-seated fissures, in the outer envelope of the planet" (*H. D. Rogers, in the Geology of Pennsylvania.* Vol. 2, Pt. 2, p. 911.)

2. Sir Charles Lyell's Theory.

Sir Charles Lyell in commenting upon the theory of Prof. Rogers says:—

"That there were great lakes, or seas of lava, retained by volcanic heat for ages, in a liquid state beneath the Alleghanies, is highly probable, for the simultaneous eruptions of distant vents in the Andes leave no doubt of the wide subterranean areas permanently occupied by sheets of fluid lava in our own times. It is also consistent with what we know of the laws governing volcanic action to assume that the force operated in a linear direction, for we see trains of volcanic vents breaking out for hundreds of miles along a straight line, and we behold long parallel fissures, often filled with trap or consolidated lava, holding a straight course for great distances through rocks of all ages. The causes of this peculiar mode of development are as yet obscure and unexplained; but the existence of long narrow ranges of mountains, and of great faults and vertical shifts in the strata prolonged for great dis-

tances in certain directions, may all be results of the same kind of action. It also accords well with established facts to assume that the solid crust overlying a region where the subterranean heat is increasing in intensity, becomes gradually upheaved, fractured, and distended, the lower part of the newly opened fissures becoming filled with fused matter, which soon consolidates and crystallizes. These uplifting movements may be propagated along narrow belts, placed side by side, and may have been in progress simultaneously, or in succession, in one narrow zone after another.

"When the expansive force has been locally in operation for a long period, in a given district, there is a tendency in the subterranean heat to diminish;—the volcanic energy is spent, and its position is transferred to some new region. Subsidence then begins, in consequence of the cooling and shrinking of subterranean seas of lava and gaseous matter: and the solid strata collapse in obedience to gravity. If this contraction take place along narrow and parallel zones of country, the incumbent flexible strata would be forced, in proportion as they were let down, to pack themselves into a smaller space, as they conformed to the circumference of a smaller arc. The manner in which undulations may be gradually produced in pliant strata by subsidence is illustrated on a small scale by the creeps in coal-mines; there both the overlying and underlying shales and clays sink down from the ceiling, or rise up from the floor, and fill the galleries which have been left vacant by the abstraction of the fuel. In like manner the failure of support arising from subterranean causes may enable the force of gravity, though originally exerted vertically, to bend and squeeze the rocks as if they had been subjected to lateral pressure.

> "Earthquakes have raised to heaven the humble vale,
> And gulphs the mountain's mighty mass entomb'd,
> And where th' Atlantic rolls, wide continents have bloom'd."

"In applying these lines to the physical revolutions of the territory at present under consideration, we must remember that the continent which bloomed to the eastward, or where the Atlantic now rolls its waves was anterior to the origin of the carboniferous strata which were derived from its ruins; whereas the elevation and subsidence supposed to have given rise to the Appalachian ridges was subsequent to the deposition of the coal-measures. But all these great movements of oscillation were

again distinct from the last upheaval which brought up the whole region above the level of the sea, laying dry the horizontal New Red Sandstone, as well as a great part of, if not all, the Appalachian chain." (*Lyell's Travels in North America*, 1st *Visit* Vol. 1, p. 78.)

Theory of the Contraction of the Sphere of the Earth.

This theory supposes that the earth was originally a fluid mass of great dimensions—that in cooling down it contracted, and that the plications of mountain chains have been produced by the folding of the crust consequent on contraction. This theory originated with Leibnitz and has been adopted by very many of the great physicists who have lived since his day. In America it has been investigated by Professor Dana and applied to the solution of the problem of the plication of the Appalachians. (See Silliman's *Journal*, 2 *series, Vol.* 2, *page* 335, *and Vol.* 3, *page* 94.

Buffon's Theory.

Buffon was of opinion that mountains and mountain chains are of submarine origin or that they are simply huge petrified mud or sand banks originally accumulated on the bottom of the sea, by the action of the waves and currents, and afterwards elevated along with the continents by subterranean forces. Buffon, it is scarcely necessary to state, never applied this idea to the Appalachians, but as it forms part of Professor Hall's theory, we quote it here; we have published it in the 1st Volume of this Journal, page 8.

Sir John Herschel's Theory.

Sir John Herschel is of opinion that the sediment as it accumulates on the bottom of the Ocean must by its weight cause the earth's crust immediately beneath to sink, while the fluid matters below being thrust aside and forced under the adjacent parts elevates tracts of land where there is no such accumulation in progress. In consequence of the swelling up of the surface in those rising regions, the strata are sometimes strained beyond their power of cohesion and cracked asunder, and thus fissures are produced through which the molten rock of the interior boils out upon the surface. Thus volcanoes, great overflows of trap, and mountains may have originated. The fact that nearly all volcanoes are found near the sea shore or near the margins of those

regions where we know that beds of sediment are being formed seems to confirm this view. (*See this Journal*, Vol. 1, pp. 194, 195.

Professor Hall's Theory.

Professor Hall's Theory appears to us to be closely related to those of Rogers, Lyell, Buffon and Herschel. The fundamental fact in the greater accumulation of sediment along the south eastern side of the Appalachians than on the south western, as evidenced by the thinning out of the strata in a westerly direction. This was pointed out by Rogers in 1842 and has also been described at greater length in his recent extensive work. Professor Hall after noticing these accumulations in detail, says:—

"When these are spread along a belt of sea bottom, as originally is the line of the Appalachian chain, the first effect of this great augmentation of matter would be to produce a yielding of the earth's crust beneath, and a gradual subsidence will be the consequence. We have evidence of this subsidence in the gradual amount of material accumulated; for we cannot suppose that the sea has been originally as deep as the thickness of these accumulations. On the contrary, the evidence from ripple-marks, marine plants and other conditions, prove that the sea in which these deposits have been successively made was at all times shallow, or of moderate depth. The accumulation, therefore, could only have been made by a gradual or periodical subsidence of the ocean bed; and we may then inquire, what would be the result of such subsidence upon the accumulated stratified sediments spread over the sea bottom?

"The line of greatest depression would be along the line of greatest accumulation, and in the direction of the thinning margins of the deposit the depression would be less. By this process of subsidence, as the lower side becomes gradually curved, there must follow as a consequence, rents and fractures upon that side; or the diminished width of surface above, caused by this curving below, will produce wrinkles and foldings of the strata.

"The sinking down of the mass produces a great synclinal axis, and within this axis, whether on a large or small scale, will be produced numerous smaller synclinal and anticlinal axes. And the same is true of every synclinal axis, where the condition of the beds is such as to admit of a careful examination. I hold, therefore, that it is impossible to have any subsidence along a

certain line of the earth's crust, from the accumulation of sediments, without producing the phenomena which we observed in the Appalachian and other mountain ranges."—*Introduction to Pal. N. Y. Vol.* 3.

Remarks on the above several Theories.

The theory of Professor Rogers depends upon the action of two forces, an upward pulsating force, and a lateral compressing force. But it appears to us that he does not show how either of these forces was generated. The cause of these forces yet remains unknown, and is it not true that to explain natural phenomena without tracing them to some known cause, is simply not to explain them at all! If this deficiency were supplied the theory might be good enough. The contraction of the mass of the earth would undoubtedly produce plications of the surface and although most physicists do believe in the former fluid condition of the planet, and its contraction during the process of consolidation, yet it remains to be demonstrated that any such contraction has taken place during that period within which the existing mountain chains were elevated. Sir Charles Lyell's theory supposes the plications to have been formed by the subsidence of the disturbed country. He thus refers the phenomena to a known cause, for it is unquestionable that there has been subsidence in the region of the Appalachians. But on the other hand, Rogers contends that the cause assigned could not have produced a plication of any important dimensions, and we have been long since convinced by his reasoning. We shall offer some mathematical proofs on this point in connection with Professor Hall's views.

Sir John Herschel refers the phenomenon of subsidence to a known cause, for we know that matter is constantly being transferred from the land to the sea bottom, or in other words that a force tending to depress the floor of the ocean is constantly accumulating there. If the crust of the earth is only a few miles in thickness, then if we could imagine the continent of America to be taken up bodily to the depth of two miles, and laid down upon Europe it is almost impossible that subsidence should not immediately take place. The molten matter beneath would be forced out and caused to flow under and elevate the ocean's bottom, and perhaps form a ring of volcanic mountains all round the margin of the depressed area. Although no such sudden transfer of matter has ever taken place, yet it can be proved that sheets of matter now converted into solid rock equal in su-

perficial extent to at least half the continent and averaging nearly a mile in thickness, have been gradually thus transferred. The total effect of the weight must be the same, whether accumulated on the region acted upon, gradually during myriads of ages, or during a single age.

Professor Hall's theory simply adds the plication suggested by Sir Charles Lyell to the subsidence theory of Sir John Herschel. We think however that although a minute plication would be the result of subsidence, the grand waves of the Appalachians could never have been formed in that way. In proof of this we shall offer a very simple mathematical demonstration.

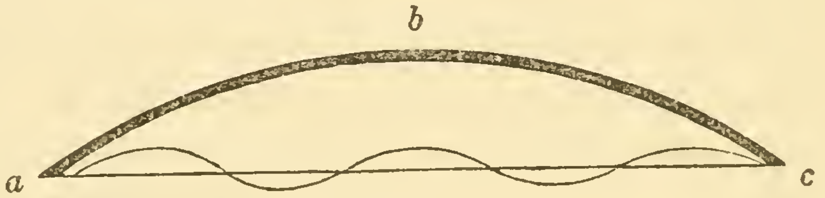


Fig. 2.

Let A. B. C. represent the section of the portion of the earth's crust undergoing subsidence. The straight line A. C. is the chord of the arc A. B. C., and therefore it is shorter than A. B. C. In the process of subsiding towards A. C. the arc A. B. C. must be compressed into a shorter space than it occupied before the subsidence commenced, and to accommodate itself to this diminished space it must become more or less undulated. It can be easily shewn than the greatest amount of undulation will take place when A. B. C. sinks to the level of A. C. It must there exhibit one or more undulations. Below that level the undulation will become gradually less in proportion to the amount of subsidence. The difference between the length of A. C. and A. B. C. will give us the measure of the greatest wave that can be produced, and provided we have the diameter of the sphere and the width of the belt undergoing subsidence, that difference can be found.

Let it be granted that the diameter of the earth is 41775500 feet; then this sum multiplied by 3.14159265 would give 131241603.75007500 feet for the circumference and this again divided by 360 would give 364560.01041687 feet as the arc of one degree.

Again multiplying 41775500 or the earth's diameter by

.0087265 (or the sine of 30′) we have 364553.9007500 for the length of the chord of an arc of one degree: Then

Arc of 1°......	364560.01041687
Chord of 1°....	364553.90075000
Difference......	6.10966687

The difference between the lengths of the chord and the arc of 1° is thus only about 6 feet and one inch. Therefore if we take any section across the Appalachians, of about 70 miles in length the greatest amount of plication that could have resulted from subsidence within it, would be a single fold, which at the most could not be three feet in height.

But there is scarcely any section of that length across the disturbed region, commencing from the eastern side, that does not exhibit the remains of four or five folds which before they were obliterated by denudation must have been a mile in height each. Let it be granted that there were originally four of such folds, and that each curve was equal to a semicircle. Then the difference between the length of a line following the surface over the four hills, and down into and across the bottoms of the four valleys, and one drawn straight through their bases, would be 4.5660 miles, or about four miles and a half. In other words to produce these four ridges of hills, the strata must have been shoved or compressed laterally four miles and a half, while by Professor Hall's process, the greatest possible distance could only be six feet and one inch. And further, in addition to this enormous deficiency there is a great deal more to be accounted for. Between and on every one of the principal folds there are very numerous smaller parallel ones. Taking all these together with the principal flexures, the amount of the lateral thrust or compression across the whole belt has been more probably eight or ten miles.

Viewed in this way the theory of plication from subsidence appears to fail altogether. Another objection to this theory is founded on the fact admitted by all parties that at least with one or two interruptions the subsidence has been gradual and the whole amount say 40000 feet distributed throughout the enormous period of time which elapsed during the Silurian Devonian and Carboniferous epochs. No man can give the length of this period, but it must have been very great. Let it be granted at

4000000 years, and the rate of subsidence would then be one foot in 100 years. We know the levelling power of running water. Any small fold that could have been produced by the subsidence of ten feet in the first thousand years would be certainly obliterated by the current of the next ten years. The same would be the result for the second 1000 years and so on to the end, at which time the bottom of the ocean would be quite level. E. B.

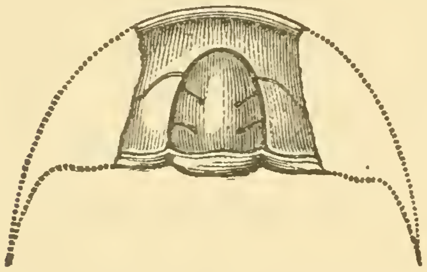
ARTICLE L.—*Description of a new Trilobite from the Potsdam Sandstone*; by FRANK H. BRADLEY, with a note by E. BILLINGS.

(*Extracted from Silliman's Journal, 2nd Series, Vol.* 30, *page* 241, *September*, 1860.

[Read before the Am. Assoc. for the Advancement of Science, at Newport.]

CONOCEPHALITES MINUTUS, (n. sp.)

1



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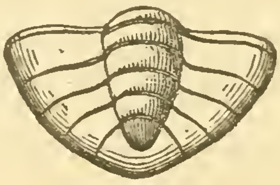

3

Fig. 1. The head magnified. The dotted lines represent the supposed outlines of the parts not preserved.

Fig. 2. The pygidium magnified.

Fig. 3. A detached cheek, magnified.

Cephalic shield apparently semi-circular, or nearly so; anterior margin as far as preserved with a narrow slightly elevated rim, just within which there is a rather strong groove. Glabella conical, slightly narrowed at the neck segment, three-fourths the whole length of the head, very convex and obtusely carinated along the median line. Neck segment rounded and prominent ; neck furrow narrow, but well defined. There are two pairs o deep glabellar furrows which are inclined inwards and backwards at an angle of about 45°; their inner extremities distant from each other rather more than one-third the width of the glabella. The anterior lobe is a little less than one-half the whole length of the glabella, excluding the neck segment; the two posterior pairs

are nearly equal to each other. The glabella is distinctly separated from the cheeks by a narrow, deep groove, which extends all round. From the anterior lobe on each side a narrow filiform ridge curves outwards and backwards on the fixed cheek to the edge of the portion preserved. The eyes appear to be situated just where these ridges terminate as represented in figure 1. Judging from the portion of the eye preserved in a detached cheek-plate, its form is semi-annular, and its length at least one-fourth that of the glabella. Caudal shield nearly as large as the head, its width scarcely equal to half its length ; the lobes nearly equal ; the middle lobe very convex with five sharp transverse grooves ; the side lobes somewhat flat, and each with five grooves.

The largest head discovered is exactly two lines in length.

The course of the facial suture has not been ascertained. The surface of the glabella in one of the specimens appears to be smooth, but in none of the others can it be distinguished.

The specimens are mostly in a clayey layer, which is full of fragments of all degrees of perfection ; in one specimen I counted ten heads and three tails, all in a fair state of preservation. In two instances, I have found the casts of maxillary plates, showing distinctly the elevated margin ; of one of which I give a figure.

The original specimens were collected, (at High Bridge, near Keeseville, N. Y.,) in August, 1856, while on a geological excursion with Col. Jewett of Albany, but were not recognised until July, 1857, when a second visit to the locality secured a few *casts* in the solid sandstone, none of the clay layer being obtained. By the kindness of Professor Dana, the specimens were presented at the Am. Assoc. for Adv. of Sci. at Montreal, but were not recognized as belonging to any known species. Since that time, I have looked for descriptions, but cannot find any to correspond.

At the same locality, I also procured the cast, of a Pleurotomaria, and one of what seems to have been a plate from the stem of a crinoid.

New Haven, June 15th, 1860.

Note by E. Billings.—Mr. Bradley having favored me with a view of his very interesting specimens, I think there can be no doubt but that they belong to the genus *Conocephalites.* If thi

reference be correct, then we have at least three, if not four species in North America.

1. *C. antiquatus* (Salter,) described from "a cast in a brown sandstone, said to be a bouldered fragment from Georgia." (See Quart. Jour. Geol. Soc., vol. xv, p. 554.)

2. *C. minutus* (Bradley.) In this species, the form of the glabella and its proportions in relation to the length of the head are almost precisely the same as in *C. antiquatus*, and yet I think the two are not identical, for the following reasons: In the first place, all the specimens of *C. minutus* are of a nearly uniform size, the length of the head being about two lines, and, therefore, it seems probable that they are the remains of adult individuals. The total length would thus be about half an inch, while Mr. Salter's species is full one inch and three-fourths. In the second place, the distance of the eye from the glabella, in *C. antiquatus* is only one-third the width of the glabella, but in *C. minutus* it must be at least one-half the width. These are the only differences that can be well made out, from the imperfect specimens, but they seemed to me sufficient to indicate two species. Mr. Salter says further, that the lobes of the glabella in *C. antiquatus* are very obscure, and that the ocular ridge, if any existed, must have been very slight. His specimen was somewhat abraded. In *C. minutus* the ocular ridge is, for so small a species, very strongly defined, and the glabellar furrows are so deep that it would require a very considerable amount of abrasion to obliterate them.

3. *C. Zenkeri*, (n. sp.) This is a new species recently discovered in the magnesian limestone near Quebec. It will probably be described in the next No. of the Canadian Naturalist and Geologist.

4. There is in the collection of the Geological Survey of Canada, a plaster cast of the surface of a fragment of rock which holds four specimens of a trilobite, each about the size of *C. antiquatus*. They appear to me to belong to the genus *Conocephalites*. The original specimen was collected in Newfoundland, in the same slate that holds *Pradxides Bennettii* (Salter,) and I am informed that it is in the possession of a gentleman who lives somewhere in the United States, but whose name or place of residence, I have not been able to ascertain.

Of the above four species, Mr. Bradley's is at present the most important as it fixes indisputably, at least one point in the geolo-

gical range of the genus on this side of the Atlantic. In Europe, *Conocephalites* has not been found out of the *primordial zone* of Barrande, but the Quebec and Keeseville specimens show that here it reaches the Lower Silurian.

Montreal, July 22nd, 1860.

(*Additional note in Silliman's Journal, Nov.* 1860.)

Since my note to Mr. Bradley's paper was written, he has collected quite a number of new specimens of *C. minutus* at the same locality. At his request I have examined them and find that they exhibit several of the parts not preserved in those upon which the original description was found.

Fig. 4, (nat. size.)

Fig. 4.—*a*, A detached cheek showing the small spine of the posterior angle.
b, *c*, Two specimens of the glabella, showing the spine on the neck segment.

1. The posterior angles of the head are produced into short spines, as we supposed, but these spines, instead of being elongate-triangular are sub-cylindrical or needle-shaped and projected outwards at an angle of 45° or thereabouts, to the longitudinal axis of the body. The cheek does not appear to be striated but rather smooth. These two characters furnish additional grounds for separating the species from *C. antiquatus* (Salter,) which has the cheeks striated and the posterior angles of the head only slightly produced into short broadly triangular terminations.

2. The neck segment bears a short broad-based spine. The first specimens collected do not exhibit this, but on reëxamining them I think I can see traces of it. Some of the specimens of *C. coronatus* (Barrande) lately collected in the Primordial Zone of Spain have a spine on the neck segment of the same form as that of *C. minutus*, while others (according to the figures) have not; and it may be that individuals of our species will yet be discovered in which the absence of the spine can be clearly established. This remark is made here because on comparing the figures of the Bohemian and Spanish specimens of *C. coro-*

natus it would appear that the presence or absence of a spine on the neck segment is not always of specific importance and should some of those from Keeseville turn out to have only a plain neck segment we would not perhaps on that ground alone be authorized to constitute two species.*

3. Mr. Bradley's new specimens also show that there are three pairs of glabellar furrows, the anterior being represented by two small indentations just in advance of the points where the ocular ridges reach the glabella; and further that the course of the facial suture is the same as it is in *C. striatus*, (Emerich). The pygidium is more obtusely rounded than is represented in our Figure 2.

As to the correctness of the generic reference of this species it may be remarked that Barrande is of opinion that no less than eleven of those which Angelin has figured under the genera *Solenopleura*, *Eryx*, *Conocoryphe*, and *Harpides* should be placed in *Conocephalites*. In this view of Barrande's, Angelin has concurred.† The genus has thus been greatly extended and judging from the form of the head (and more particularly of the glabella) of Angelin's species *C. brachymetopus*, *C. homelotopus* and *C. canaliculatus* I think we are perfectly justified in referring this species to *Conocephalites*. The genus is most closely allied to *Calymene*, having the same number of segments in the thorax —the same number and arrangement of pieces in the head and the same general form and lobation of the glabella, the differences between the genera consisting principally in certain characters of the pleuræ and hypostoma ‡ to which may be added the ocular ridge which although not a constant character in *Conocephalites* may be regarded as of some generic value as it does not occur at all in *Calymene*. I would also state that since examining Mr. Bradley's recent collection, I have been strongly

* Compare the article, *Sur l'existence de la faune primordiale dans la chaine cantabrique*, par M. Casiano de Prado; suivie de la *Description des fossiles*, par MM. de Verneuil et Barrande. Bulletin Geol. Soc. France, 2o Series, vol. xvii, p. 516, (1860). And also Barrande's *Système Silurien*, plate 13.

† See Barrande's "*Parallèle entre les dépôts Siluriens de Bohême et de Scandinavie*, p. 19; and compare the tables on p. 17 and 35 of the same work. See also Angelin's *Palæontologia Scandinavica.*

‡ See Barrande, "*Systême Silurien du centre de la Bohême*," p. 417-419.

impressed by the resemblance between the form of the cheek and small needle-shaped posterior spines of *C. minutus* and the same parts of the head of the Quebec species which I have called *Menocephalus globosus*, and it appears to me that *Menocephalus* must be regarded as another closely allied genus. If we except those two genera, *Calymene* and *Menocephalus*, there is no other but *Conocephalites* to which our new trilobite bears any near affinity.

Mr. Bradley has since the publication of the above received a collection of Fossils from the Potsdam sandstone of the western states among which are several specimens of *C. minutus*. They were collected at a place called Black River Falls in Wisconsin where they occur associated with several of the species described by Dale Owen.

E. B.

ARTICLE LI.—*Notes on Birds wintering in and around Montreal.* From observations taken during the winters of 1856–57–58–59–60. By H. G. Vennor, junr.

Few of our birds can endure the severe winters we generally have in this part of Canada. Soon as the icy breath of that hoary season is felt, and often long before, our feathered songsters hasten to their southern feeding grounds. A few, however, that seem loath to leave their summer haunts, loiter about until winter has come in reality, and then, as if aware that they have been imprudent, haste away in the same direction. These are our loiterers, and must not be confounded with our real winter residents. Others again, bid defiance to the severity of winter, and remain eagerly searching for their food, in the bare, and now apparently lifeless trees. It is to this class of birds, that I have, for the last four winters, turned my attention.

Again, there are a few birds which come from the North every winter, and return thither as soon as the cold weather leaves us. The Pine Grosbeak, Bohemian Wax-wing, and common Snow-bunting, are examples. For this reason, it is difficult to make out an accurate list of the birds which remain here the whole year round, and unless the observations extend over several winters, it is almost impossible. On comparing my notes of the last five winters, I find that the list of birds varies every winter, as the weather has

been mild or severe. During severe winters, we always have a good number of northern visitors, and very few loiterers; on the other hand when the winter is rather mild it is the reverse.

One of our smallest, and yet most active winter birds, is the Black-cap Tit (*Parus atricapillus*). They may be seen nearly everywhere during the winter months; sometimes in flocks, and again in pairs. While feeding they utter a sharp chip, and when flying and then suddenly alighting they pipe out their chick-a-dee-dee, from which sound they derive their familiar name.

The Downy Woodpecker (*Picus pubescens*). This little Woodpecker is also very common around Montreal during the winter months. It may often be seen in company with the Black-caps.

The Hairy Woodpecker (*Picus villosus*) is not often seen here during the winter. I have not met with it myself, but have obtained specimens shot in the vicinity.

The Pileated Woodpecker (*Picus pileatus*). This bird is rare in this part of Canada, as it remains in the interior of the woods, both in summer and winter. I have a specimen that was shot a little below the town.

The Arctic Woodpecker (*Picus arcticus*) is seen here now and again during the winter; and I am told by a friend, they often visit our mountain during the summer. I have a specimen which I obtained near the Mile-end quarries in 1858.

The Brown Creeper (*Certhia familiaris*) is not very abundant during winter, yet it winters in Canada. During the month of February, 1857, they were very numerous on Nun's Island, and there have generally been some in a small pine grove on the top of our mountain every winter.

The Brown-bellied Nuthatch (*Sitta Canadensis*) is not very often seen during the winter months. On a mild day, one may see several of them, and then they suddenly disappear for a time. They frequent the same localities as the former bird.

The White-bellied Nuthatch (*Sitta Carolinensis*) is very common during February on Nun's Island; they utter the same note as the other, and are somewhat larger.

The Robin or Migratory Thrush (*Turdus migratorius*). This bird is a loiterer, and often appears late in the winter, and very early in the Spring. One was shot November 1856, and another seen January 1857; and last winter, on the 19th of February, I saw a large one in our garden. It is strange how they manage to live at all, when they loiter here half the winter. Their Spring arrival is in the month of April.

The Pine Grosbeak (*Pyrrhula enucleator*) arrives from the north about December, and remains here until March ; they feed on the Mountain Ash berries while here.

The Bohemian Wax-wing (*Bombycilla garrula*). This bird only visits us during the most severe weather, and then it arrives in pretty large flocks. I first observed this bird at the commencement of the winter of 1857. We had some very cold weather at that time, and several large flocks of wax-wings, intermingled with grosbeaks arrived, and frequented the small mountain, and the gardens throughout the island, where there were any berries to be found. The wax-wings remained until April when they disappeared. I have not noted this bird since.*

The Lesser-red-Poll (*Linaria minor*). These birds are numerous throughout the winter, the greatest number may be seen about the beginning of February.

The Blue Jay (*Garrulus cristatus*). One of these birds was shot 25th November near Mile-end road quarries, several others were seen during the winter behind our mountain. They winter at Sorel.

The Canada Jay (*Garrulus Canadensis*). This bird is not very common here, but is often seen by hunters in the thick woods, between this and Ottawa. I obtained some specimens during 1859, in the market: they were shot near the town ; last winter I saw another specimen brought to the market. This bird is common at Hudson's Bay.

Shrike (*Lanius Borealis*). This bird is not a winter resident, but a loiterer. A few straggling ones may be seen as late as January. During the cold weather it feeds on mice, and other small animals. It is rare here, both in summer and winter.

Snow Bird (*Niphœa hyemalis*). This bird stays as late as the middle of November, but does not loiter longer.

Snow Bunting (*Plectrophanes nivalis*). Very abundant ; large flocks always to be seen on the frozen rivers, and on Nun's Island, and along the country roads.

The Ruffed Grouse (*Tetrao Umbellus*). I have noticed the tracks of this bird, over several places on our mountain during the winter

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* Since writing the above, I have been told by Mr. Hunter (cabinet keeper of the Museum of Natural History), that the Bohemian Chatterers were noticed by him the two last winters, although not in such number as during 1857.

and although I only saw one bird there during the winter of 1859, yet, I am confident they are numerous on some parts of the mountain. They are also found in a swamp near Mile-end road.

Ptarmigan or Arctic Partridge. (*Tetrao mutus*). I bought a fine specimen of this bird from a Canadian in the market; it was shot near Sorel.

Owls. The winter is the owls' summer, yet they stay with us both winter and summer. During the hot weather they retire to the depths of the forests. But in winter they roam over plains, forests and villages, some even taking up their abode in barns to prey upon the mice, &c. I have seen the great Horned Owl (*Strix Virginiana*) sitting on a barn near Sherbrooke street. There are of them more or less every winter for sale in the market.

To commence, we will take the Hawk Owl (*Strix funerea*). This bird is in some respects like an Hawk, and in others like the Owl, but it is an Owl nevertheless. It becomes very abundant in the fall, or rather beginning of December, and generally stays all winter; they fly about by day more than the other species.

The Barred Owl (*Strix nebulosa*). I saw a specimen of this Owl as early as September this year. They have been seen during January and most of the winter on Nun's Island, and sometimes on our mountain. It is also seen on St. Helen's Island, one being shot there January 1857. I have seen it exposed for sale in the market for the last four winters.

The Little Owl (*Strix passerina*) is not very often seen; I have one specimen from our mountain shot several winters ago.

The Short Eared Owl. (*Strix brachyotus*). I obtained a specimen of this owl also from our mountain last winter.

The Long Eared Owl. (*Strix otus*). This owl is very rare here also, it is sometimes seen on the Mile-end race-course, and at Logan's farm.

The Great Horned Owl (*Strix Virginiana*) is common about Montreal during winter, specimens being for sale every winter in the market. I kept one of these birds alive for some time; he ate raw meat voraciously.

The Snowy Owl, (*Strix nyctea*) is rather rare about the immediate neighbourhood of the city, but is generally brought into the market every winter. I have noticed it at Nun's Island and on our mountain. The winter of 1859 brought seven Snowy Owls to the market, last winter (1860) there were only two in the same

market; they were all young, none having the pure white plumage of the old birds.

Hawks. The fall is the feasting time for the Hawks, rarely are they to be seen during the winter. The winter Falcon is sometimes shot on our mountain.

The Goshawk (*Falco palumbarius*) however, remains here the whole winter, and is seen more frequently during that season. He generally keeps himself pretty deep in the woods, and unless driven by hunger, will rarely approach the habitation of man; when he is thus driven, woe to the farmers' sheep, ducks, geese, &c !

The Snipe (*Scolopax Wilsonii*). Specimens of this bird have been shot as late as Christmas day, but these are only loitering long after the usual time of their departure.

The birds mentioned in the above are all that have come to my notice, during the winters of 1856–57–58–59–60. Others may have noticed some I have not seen, and by making them known, would thus add to the list already commenced by Mr. D'Urbain, in the Naturalist, vol. 2, p. 138. It was his article that made me think of adding my contribution to the list.

I subjoin a list of all the birds I have noted these last few winters, placing the letter L before the names of the loiterers.

List of birds observed during the winters of 1856–57–58–59–60.

	Black-cap Tit...............	(*Parus atricapillus*).
	Downy Woodpecker........	(*Picus pubescens*).
	Arctic "	(*Picus arcticus*).
	Pileated "	(*Picus pileatus*).
	Brown creeper.............	(*Certhia familiaris*).
L.—	Robin.	(*Turdus migratorius*).
	Blue Jay....................	(*Garrulus cristatus*).
	Canada Jay.................	(*Garrulus Canadensis*).
L.—	Shrike......................	(*Lanius Borealis*).
L.—	Snow bird..................	(*Niphæa hyemalis*).
	Snow bunting..............	(*Plectrophanes nivalis*)
	Pinegrosbeak..............	(*Pyrrhula enucleator*).
	Wax-wing..................	(*Bombycilla garrula*).
	Nuthatch...................	(*Sitta Canadensis*).
	Lesser red Linnet..........	(*Linaria minor*).
	Ruffed grouse..............	(*Tetrao umbellus*).
	Ptarmigan..................	(*Tetrao mutus*).
	Hawk Owl	(*Strix funerea*).

Barred "	(*Strix nebulosa*).
Screech "	(*Strix asio*).
Short-eared Owl	(*Strix brachyotus*).
Long " "	(*Strix virginiana*).
Horned "	(*Strix bubo*).
Snowy-day "	(*Strix nyctea*).
Winter Falcon.......	(*Falco lineatus*).
Goshawk..................	(*Falco palumbarius*).
L.—Snipe.....................	(*Scolopax Wilsonii*).

Making a total of 23 winter residents and 4 loiterers.

The American Crow (*Corvus Americanus*) has been seen here sometimes during November and December.

The Blue Robin (*Sialia Sialis*) is also mentioned by some as remaining here, but it must be very rarely. He arrives early in spring, and his song is the first we hear, welcoming summer; he generally moves southward about November.

Montreal, Nov. 15th, 1860.

ARTICLE LII.—*Notes on Aboriginal Antiquities recently discovered in the Island of Montreal.*

(Read before the Natural History Society of Montreal.)

Toward the end of last month the writer was informed that some workmen employed by Edmond Dorion, Esq., had discovered what were supposed to be Indian remains, near Mansfield street. On application to Mr. Dorion, he kindly gave the specimens in his possession for presentation to the Natural History Society, and instructed his labourers to preserve any other remains that might occur. The specimens obtained from Mr. Dorion consisted of a skull evidently of American type, fragments of a second skull, and portions of earthen vessels similar to those made by the aborigines before the colonization of the country.

The place in which the remains were found is immediately below Sherbrooke street, between Mansfield and Metcalfe streets and in the line of Burnside Place. It is a part of the dry sandy knoll or terrace, between the College Brook and that running through Honorable Judge Smith's property, on the level of Sherbrooke street, and sloping rapidly toward the flat in rear of St. Catherine street. The ground has been ploughed, but is at present vacant and used for the excavation of sand for building. The sand is of the Post-

Pliocene deposit which I have elsewhere called the "Saxicava sand,"* and is from two to six feet in thickness, resting on an uneven surface of the "Leda clay."

On inquiry, I found that the workmen employed in removing sand, have, at several times, found skeletons, and have buried them in the clay below the sand bed, where perhaps at some future time they may lead to the supposition that in Canada man was contemporary with this historically very old though geologically very recent deposit. I record the fact of the transference of these skeletons to the Leda clay, to prevent, if possible, the occurrence of an error so serious.

The skeleton found by Mr. Dorion was in a sitting or crouching posture, but no note had been taken of the precise position. A few days afterward the workmen uncovered another which I saw in situ. It is that of a man perhaps 50 years of age. The body lay in an inclined position, the head toward the west, and the face toward the south or south-west. The knees were bent up close to the chest, and the arms placed in such a position that the hands were opposite the face. The bones were perfect as to their form, but were stained yellow by the oxide of iron in the sand, and had become brittle owing to loss of animal matter. The hair and all the soft parts had entirely disappeared, and the skeleton had evidently been reposing for centuries where it was found. No wrappings of any kind enclosed it, nor could any object of art be found in the surrounding sand. It was about two feet below the surface of the ground. Another skeleton subsequently found, lay with the head toward the east, in the same crouching position. Fragments of an earthen vessel were found near its hands. All the above were remains of aged persons; but the workmen also found the skeleton of a child perhaps 8 or 9 years of age, parts only of which were preserved.

On examining the ground in the vicinity of the excavations, I found that the locality had been the site not merely of a cemetery of the aborigines, but also of a village or encampment. Fragments of pottery and other artificial objects and bones of wild animals are scattered abundantly through the soil, especially in the neighbourhood of spots where ashes and charcoal indicate the position of domestic fires. Some of these fires had been made on the surface, but others in pits about a foot in diameter and of the

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* Canadian Naturalist II, p. 402, Fig. 1, E, f.

same depth, and the remains of pottery and other objects were in such quantity in their vicinity as to indicate a long residence of the tribe which had inhabited the spot. These occur abundantly on the S. W. side of Metcalfe street, on the margin of the little brook which separates this site from the similar platform on which the building for the ball in honour of the Prince of Wales was erected, and they extend thence to Mansfield street, and from the margin of the terrace toward St. Catherine street more than half way to Sherbrooke street, or in all a space of rather more than 100 yards in diameter. The removal of a great part of the sand has much changed the natural form of the ground, but it seems to have been a slightly rounded sandy knoll with a little depression running diagonally through it, and the habitations indicated by the sites of fire places seem to have encircled the most elevated part of the ground in which most of the skeletons occur. A considerable part of this space is not yet excavated and may afford many additional remains.

I shall now describe the objects found, beginning with the human remains. Of these we have principally three skulls, one female and two male, nearly perfect. The fragments of the others are not in a condition to afford much information.

1. *Skull of an aged female.*—This is distinctly pyramidal at the vertex, with prominent superciliary ridges, receding but convex forehead and elongated occiput. Its dimensions are as follows, column (1) :

	(1)	(2)	(3)
Longitudinal diameter..	6.75 in.	7.50 in.	7.05 inches.
Parietal diameter*.........	5.25 "	5.75 "	5.50 "
Frontal diameter...........	4.00 "	5.00 "	4.75 "
Vertical diameter...........	5.30 "	5.50 "	5.50 "
Intermastoid arch..........	12.00 "	13.50 "	13.50 "
Occipito-frontal arch........	13.75 "	14.40 "	14.50 "
Horizontal circumference....	19.25 "	21.00 "	20.75 "

The bones of the face and jaws are very small and delicate compared with those of the male skulls. This skull is in the Museum of the Natural History Society.

2. *Skull of a man*, perhaps aged 50 years. The vertex in this skull is not pyramidal but rounded, the forehead full and the superciliary ridges by no means prominent. The occiput

* Greatest immediately above the squamous suture.

less elongated than in No 1. The bones of the face are strong with prominent zygoma, and the lower jaw is very massive. The dimensions are as above, column (2).

This specimen also, with the rest of the skeleton, is in the Museum of the Natural History Society.

3. *Skull of an aged man.*—This is in general aspect like No. 2. Its dimensions are as above, column (3).

This skull is in the Museum of McGill College. Its form is illustrated in Figs. 1, 2 and 3.†

Fig. 1.

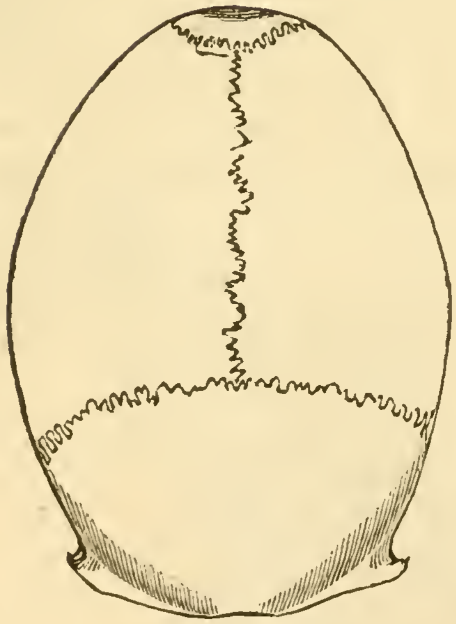

Fig. 2.

Fig. 3.

Figs. 1, 2, 3, Aboriginal Skull from site of an village at Montreal.

All of the above are dolichokephalic or elongated skulls, a form which Prof. Wilson has shewn to prevail among the Huron tribes, and which Retzius * maintains to be general in the Eastern Americans as distinguished from those of the West coast.

* Smithsonian Report, 1859.

† The forehead in Fig. 2 is incorrectly shaded.

They exhibit a very respectable development of brain, especially in the male skulls, and they show the fallacy of the conclusions hastily adopted by some ethnologists as to the supposed distinctness in form of the American skull from that of the populations of the old world, and its supposed general brachykephalic type. Facts to be stated in the sequel show that these skulls must have belonged to an ancient and unmixed American people. and they are markedly characterised by the American type of face; but the brain case in form and dimensions differs little from types prevalent among European races.

4. *Remains of articles of food.*—In and near the little hearths or ovens above mentioned, are numerous bones of animals, some in a condition sufficiently perfect to permit their determination. Among them are remains of the Bear, Beaver, Deer, Dog, Fox; of several fishes; especially the Cat-fish, Corvina and Sturgeon; and of birds. Shells of Unio gibbosa, the most common fresh water mussel in the St. Lawrence near Montreal, charred grains of Indian Corn and stones of the wild cherry, also occur.

5. *Earthen Vessels.*—These appear to have been of the usual form of those made by the aborigines, rounded below and rising with a graceful double curve toward the mouth, which is either round or square with prominent corners, the latter form giving a very elegant outline. For the general form I may refer to the figure and description of an Indian vase from the Ottawa in this Journal, Vol. 4, p. 188. The sides and bottom of these vessels are usually smooth, but in one or two instances are covered with square indentations giving a sort of netted pattern. (Fig. 4). The

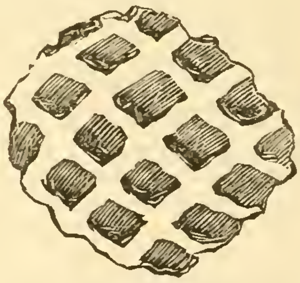

Fig. 4.

mouths and necks are ornamented with depressed lines and notches variously arranged, with circles stamped on the clay, and with prints made by the point of the finger. The patterns are various and often very tasteful. A few of them are represented of half the actual dimensions in figs. 5 to 10. The material is clay mixed

with sand, often well smoothed and finished, but without any glazing. Some pieces are well burned, and most of the fragments are

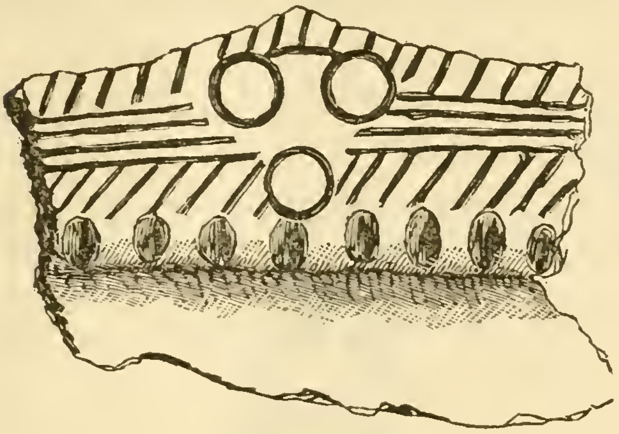

Fig. 5.

Fig. 6.

blackened by long use, though some others seem quite fresh, as if not used at least for culinary purposes.

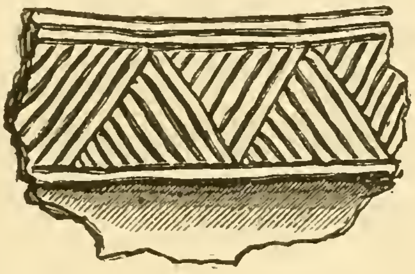

Fig. 7.

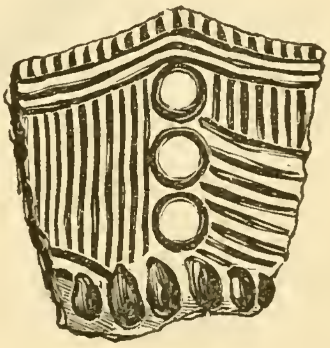

Fig. 8.

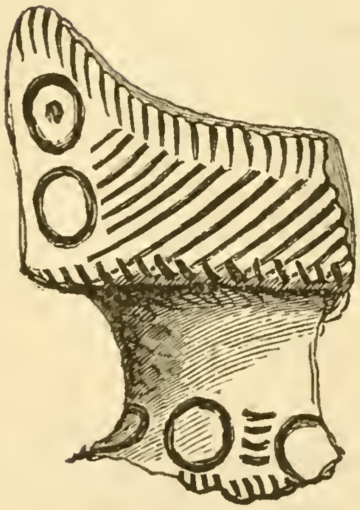

Fig. 9.

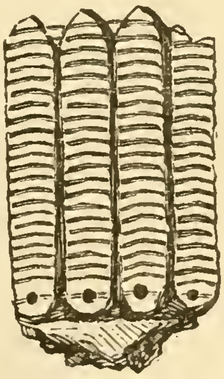

Fig. 10.

6. *Tobacco Pipes.*—Many fragments of these occur, all of clay well baked and often of fine quality. The patterns are various and some of them very elegant: one of the most perfect is represented in Fig. 11.

7. *Other earthen objects.*—One of these is a portion of a disk of baked clay, ornamented on one side, and perhaps used in some

game, (Fig. 12). Another is a fragment of earthenware ground into a circular form and possibly used for a similar purpose. Another is a conical body of unknown use, roughly shaped.

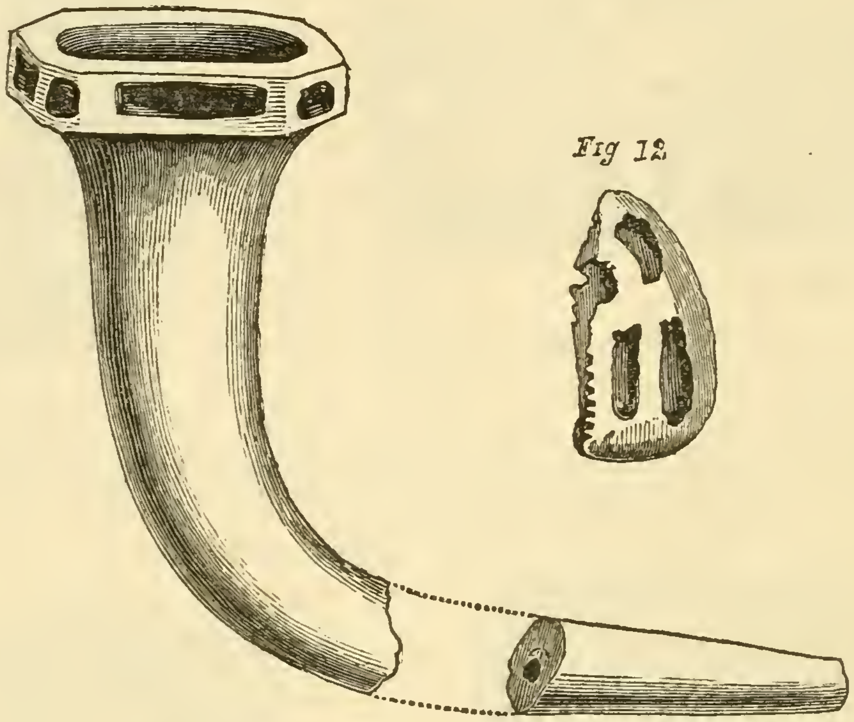

Fig 12

Fig. 11, Clay Pipe, half actual size.

Another fragment is apparently the handle of a flat earthen vessel. (Fig. 13.)

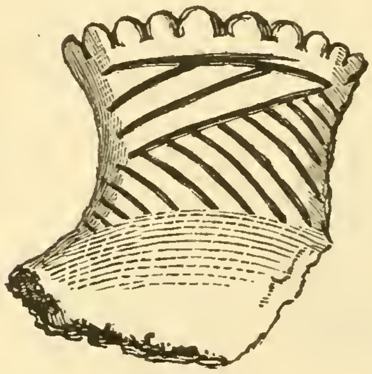

Fig. 13.

8. *Bone Implements.*—The most interesting of these is a conical bodkin with a circular stamp at the larger end, neatly made, and which was evidently used in ornamenting the pottery found with it, the circular stamp fitting into the circles on some of the vessels, and the point being very suitable for making the lines or scratches (Fig. 14). It is cut out of solid bone from the leg of some animal, the thicker end being from the cancellated bone near the joint. Other bone skewers or bodkins of ruder form were also found.

9. *Stone implements.*—Many oval and sharp edged stones, which

may have been used for hammers and knives, were found, but none of them artificially shaped. There are also numerous stones showing marks of fire and probably used for supporting pots or for heating water or for baking. One regularly oval piece of trap about five inches in its longest diameter, has evidently been shaped by art and ground flat on one of its sides. It may have been used as a pestle for grinding, or perhaps may have been heated in the fire for baking cakes in the manner described by Cartier. Another of triangular form has been perforated by a Saxicava in the tertiary period,as is the case with many of the loose fragments of limestone near the mountain of Montreal, and has perhaps been used by the Indians as a sinker. No arrow heads or other weapons of stone have as yet been found; but I have a fragment of an arrow head of greenish jasper which was found in my garden, at no great distance from the site in question.

10. *Iron implements.*—Two small pieces of iron were found with two bone bodkins near one of the fire places, and probably belong to the Indian relics. One of them is apparently a small knife or oblique edged chisel about three inches in length, and such as the Indians themselves may have made from a scrap of foreign iron obtained from some of their early European visitors (Fig. 15). The other is a square piece of flat iron, perhaps a portion of an iron hoop or of a large knife.

Fig. 14.

Fig. 15.

Fig. 14, Bodkin, half actual size. Fig. 14, Iron knive, half actual size

The historical importance of these relics depends to a great extent on the answer to the question, whether they belong to the aborigines who inhabited Hochelaga at the time of its discovery

by Cartier, or to any previous or subsequent occupancy of the Island of Montreal by Indians.

On the 3rd of October, 1535, Cartier landed on the Island of Montreal, and visited an Indian village which he calls Hochelaga, a name apparently referring rather to the district than to the town itself. In 1540, in his third voyage, of which unfortunately only imperfect records remain, he mentions apparently at the same place a village which he calls Tutonaguy; and as he had learned in the meantime to apply the name Hochelaga to a region or district of country, it is probable that this is the same place previously named Hochelaga. In 1603, Champlain appears to have found that the village of Hochelaga had dwindled away or disappeared, and we hear no more of its site until in 1642, when Montreal was founded by the French under the Sieur Maisonneuve. On this occasion some very interesting statements are made in the Jesuits' memoirs, respecting the fate of Hochelaga. (1642, chap. 9.) We are informed that at this date no trace of Cartier's Hochelaga was known, except a name which the Indians had given to the island, importing that it had been the site of a village or fort. Further two aged Indians who accompanied some of the new colonists to the mountain top, stated that they were descendants of the original inhabitants; that their tribe had at one time inhabited all the surrounding region, even to the south of the river, possessing many populous villages; that the Hurons, who at that time were hostile to them, had expelled them; that some of them had taken refuge among the Abenaquis, others among the Iroquois, others among the Hurons themselves. One of them farther stated that his grandfather had cultivated the very place before them, and expatiated on the excellence of its soil and climate for the cultivation of Indian corn; but the incursions of the Iroquois were too much dreaded to permit the reoccupation of the island. The missionaries farther remark that these people once sedentary and cultivators of the soil, had become migratory, owing to the dangers to which they were exposed, a very important fact as we shall perceive in the sequel. One of the men above referred to was named Atcheast, and other statements show that he was one of a band regarded as Algonquins by the missionaries. These people were invited by the French to return to the Island of Montreal, and were promised protection from the Iroquois, but their fears do not seem to have been overcome until the conclusion of peace in 1646, when a

number of families, including as we are informed some of the descendants of the original inhabitants, formed a settlement, which appears to have subsisted only for a short time, when renewed fears of the Iroquois took possession of them. Some remained, however, sufficiently long to plant some Indian corn. We have at this time the important statement that those who regarded themselves as original Montrealers spoke the Algonquin tongue, and that their tribal name was Onontchataranons or Iroquet. Their chief at this time was Taouichkaron. This is the last historical notice I have found of this people, and they appear to have been dispersed and to have disappeared from Montreal on the renewal of the war with the Iroquois in the following year.

It appears from the preceding statements that if, as seems almost certain, the remains recently found indicate the site of an Indian village, they may have belonged either to the Hochelaga of Cartier, or to the later settlement in 1646, unless indeed this second settlement took place on the precise site of the old village, in which case it might be difficult to distinguish the remains of the later from those of the earlier. With respect to the second and third of these alternatives, it seems probable that after the French occupation of the island, and at a time when the missionaries were labouring successfully among these people, the site of their village would present more traces of European intercourse than occur at the place in question. Afraid as they were of the Iroquois, it also seems probable that they would settle as near as possible to their allies, whose abodes were close to the river. Farther it appears impossible that so much broken pottery and other rejectamenta could result from the residence of a few families for one year. The remains rather indicate a place long occupied. For these reasons I am disposed to regard it as the most probable alternative, that the site in question is that of the original village seen by Cartier in 1535, unless on consulting his narrative we should find reason to reject this view also. That the reader may judge for himself, I reproduce here the original statements of the observant old voyager, in Hakluyt's excellent English version, with some emendations suggested by Prof. Darey of McGill College, who has kindly compared it with the French, as given in the edition of the Quebec Natural History Society. Between these copies several differences occur, which no doubt in part arise from Hakluyt's translation

having been made from the earlier texts now lost, but some of them are pretty evidently errors of translation. Our extracts refer to the day following Cartier's arrival at the Island of Montreal, and his landing as is believed below the Current.

"The Captaine the next day very earely in the morning, having attired himselfe, caused all his company to be set in order to go to see the towne and habitation of those people, and a certaine mountaine that is neere the citie; with whom went also five gentlemen, and twentie Mariners, leaving the rest to keepe and looke to our boates: we tooke with us three men of Hochelaga to bring us to the place. All along as we went we found the way as well beaten and frequented as can be, the fairest and best country that possibly can be seene, full of as goodly great okes as are in any wood in France, under which the ground was all covered over with faire akornes. After we had gone about foure or five miles, we met by the way one of the chiefest lords of the citie, accompanied with many moe, who so soone as he sawe us beckned and made signes upon us, that we must rest us in that place where they had a great fire, and so we did. Then the said lord began to make a long discourse, even as we have saide above, they are accustomed to doe in signe of mirth and friendship, shewing our Captaine and all his company a joyfull countenance, and good will; who gave him two hatchets, a paire of knives and a crucifix which he made him to kisse, and then put it about his necke, for which he gave our Captaine heartie thankes. This done, we went along, and about a mile and a halfe farther, we began to finde goodly and large cultivated fieldes, full of such corne as the countrie yeeldeth. It is even as the Millet of Bresil, as great and some what bigger then small peason, wherewith they live even as we doe with our wheat. In the midst of those fields is the citie of Hochelaga, placed neere, and as it were joyned to a great mountaine* that is tilled round about, very fertill, on the top of which you may see very farre, we named it Mount Roiall. The citie of Hochelaga is round, compassed about with timber, with three course of Rampires, one within another framed like a sharpe spire, or pyramid, but laid acrosse above. The middle most of them is perpendicular. The Rampires are framed and fashioned with pieces of timber, layd along very well and cunningly joyned togither after their fashion. This enclosure is in height about two rods.† It hath but one gate or entrie thereat, which is shut

* Literally—"which surrounds it, well cultivated and very fertile."

† French,—"deux lances." The drawing in Ramusio's translation would give a height of about 16 feet.

with piles, stakes, and barres. Over it, and also in many places of the wall, there is a kind of gallery to runne along, and ladders to get up, all full of stones and pebbles for the defence of it There are in the towne about fiftie houses, at the utmost about fiftie paces long, and twelve or fifteen broad, built all of wood, covered over with the barke of the wood as broad as any boord, very finely and cunningly joyned togither according to there fashion. Within the said houses, there are many roomes. In the midest of every one, there is a great hall, in the middle whereof they make their fire. They live in common togither: then doe the husbands, wives and children each one retire themselves to their chambers. They have also on the top of their houses certaine granaries,* wherein they keepe their corne to make their bread withall; they call it Caracony, which they make as hereafter shall follow. They have certaine peeces of wood, like those whereon we beat our hempe, and with certain beetles of wood they beat their corne to powder; then they make paste of it, and of the paste, cakes or wreathes, then they lay them on a broad and hote stone, and then cover it with hote pebbles and so they bake their bread instead of ovens. They make also sundry sorts of pottage with the said corne and also of pease and of beanes, whereof they have great store, as also with other fruits, great cowcumbers and other fruits. They have also in their houses certaine vessels as bigge as any But or Tun, wherein they keepe their fish, causing the same in sommer to be dried in the smoke and live therewith in winter, whereof they make great provision, as we by experience have seene. All their viands and meates are without any taste or savour of salt at all. They sleepe upon barkes of trees laide all along upon the ground being over-spread with the skinnes of certaine wilde Beastes, wherewith they also clothe and cover themselves, namely of the Dormouse,† Beaver, Martin, Fox, Wild Cat, Deer, Stag, and other wild beasts, but the greater part of them go almost naked (during the summer). The thing most precious that they have in all the world they call Esurguy; which is white and which they take in the said river in Cornibots,‡ in the manner following.

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* Corn-cribs. † ? Musk-rat.

‡ This word seems to have puzzled the translators. It is probably a vulgar local name for some shell supposed to resemble that of which these Indians made their wampum. I would suggest that it may be derived

When any one hath deserved death, or that they take any of their enemies in warres, first they kill him, then with certain knives they give great slashes and strokes upon their buttocks, flankes, thighs and shoulders; then they cast the same bodie so mangled downe to the bottome of the river, in a place where the said Esurgny is, and there leave it ten or twelve houres, then they take it up againe, and in the cuts find the said Esurgny or Cornibots. Of them they make beads, and use them even as we doe gold and silver, accounting it the precioussest thing in the world. They have this vertue in them, they will stop or stanch bleeding at the nose, for we prooved it. These people are given to no other exercise, but onely to husbandrie and fishing for their sustenance: they have no care of any other wealth or commoditie in this world, for they have no knowledge of it, and never travell and go out of their country, as those of Canada and Saguenay doe, albeit the Canadians with eight or nine Villages more alongst that river be subjects unto them.

So soone as we were come neere the towne, a great number of the inhabitants thereof came to present themselves before us, after their fashion, making very much of us: we were by our guides brought into the middest of the towne. They have in the middlemost part of their town a large square place, being from side to side a good stone cast, whither we were brought, and there with signes were commanded to stay and so we did: then suddenly all the women and maidens of the towne gathered themselves together, part of which had their armes full of young children, and as many as could came to kiss our faces, our armes, and what part of the bodie soever they could touch, weeping for very joy that they saw us, shewing us the best countenance that possibly they could, desiring us with their signes, that it would please us to touch their children. That done, the men caused the women to withdraw themselves backe, then they every one

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from *cornet*, which is used by old French writers as a name for the shells of the genus *Voluta*, and is also a technical term in conchology. In this case it is likely that the Esurgny was made of the shells of some of our species of Melania or Paludina, just as the Indians on the coast used for beads and ornaments the shells of Purpura lapillus and of Dentalium, &c. It is just possible that Cartier may have misunderstood the mode of procuring these shells, and that the statement may refer to some practice of making criminals and prisoners *dive* for them in the deeper parts of the river.

sate downe on the ground round about us, as if we would have shewen and rehearsed some comedie or other shew : then presently came the women againe, every one bringing a fouresquare matte in manner of carpets, and spreading them abroad on the ground in that place, they caused us to sit upon them. That done, the Lord and King of the country was brought upon 9 or 10 men's shoulders, (whom in their tongue they call Agouhanna) sitting upon a great stagges skinne, and they laide him downe upon the foresaid mats neere to the capitaine, every one beckning unto us that hee was their Lord. This Agouhanna was a man about fiftie yeeres old: he was no whit better apparelled then any of the rest, onely excepted. that he had a certain thing around his head made of the skinnes of Hedgehogs * like a red wreath. He was full of the palsie and his members shronke together. After he had with certaine signes saluted our captaine and all his companie, and by manifest tokens bid all welcome, he shewed his legges and armes to our capitaine, and with signes desired him to touch them, and so he did, rubbing them with his owne hands: then did Agouhanna take the wreath or crowne he had about his head, and gave it unto our capitaine, that done they brought before him diverse diseased men, some blinde, some criple, some lame and impotent, and some so old that the haire of their eyelids came downe and covered their cheekes, and layd them all along before our capitaine, to the end they might of him be touched; for it seemed unto them that God was descended and come down from heaven to heale them. Our capitaine seeing the misery and devotion of this poore people, recited the Gospel of St. John, that is to say, "In the beginning was the Word," making the sign of the cross upon the poor sick ones, praying to God that it would please him to open the hearts of this poore people, and to make them know our holy faith, and that they might receive baptisme and christendome, that done, he tooke a service-booke in his hand, and with a loud voice read all the passion of Christ, word by word, that all the standers by might heare him, all which while this poore people kept silence, and were marvellously attentive, looking up to heaven, and imitating us in gestures. Then he caused the men all orderly to be set on one side, the women on another, and likewise the children on another, and to the chiefest of them he gave hatchets, to the other knives, and to the

* Porcupines.

women beads and such other small trifles. Then where y children were, he cast rings, counters, and broaches made of tin, whereat they seemed to be very glad. That done, our capitaine commanded trumpets and other musicall instruments to be sounded, which when they heard, they were very merie. Then we tooke our leave and went away; the women seeing that, put them selves before to stay us, and brought us out of their meates that they had made readie for us, as fish, pottage, beanes, and such other things, thinking to make us eate, and dine in that place; but because the meates were not to our taste we liked them not, but thanked them, and with signes gave to understand that we had no neede to eate. When we were out of the towne, diverse of the men and women followed us, and brought us to the toppe of the foresaid mountaine, which wee named Mount Roial, it is about a quarter of a league from the towne. When as we were on the toppe of it, we might discerne and plainly see thirtie leagues about. On the northside of it there are many hilles to be seene running west and east, and as many more on the south, amongst and betweene the which the countrey is as faire and as pleasant as possibly can be seene, being levell, smooth, and very plaine, fit to be husbanded and tilled, and in the middest of those fieldes we saw the river further up a great way then where we had left our boates, where was the greatest and the swiftest fall of water that any where hath beene seene which we could not pass, and the said river as great wide and large as our sight might discerne, going southwest along three faire and round mountaines that we sawe, as we judged about fifteene leagues from us. Those which brought us thither tolde and shewed us, that in the sayd river there were three such falles of water more, as that was where we had left our boates; but we could not understand how farre they were one from another. Moreover they shewed us with signes, that the said three fals being past, a man might sayle the space of three monethes more alongst that river, and that along the hilles that are on the north side there is a great river, which (even as the other) cometh from the west, we thought it to be the river that runneth through the countrey of Saguenay, and without any signe or question mooved or asked of them, they tooke the chayne of our capitaines whistle, which was of silver, and the dagger-haft of one of our fellow mariners, hanging on his side being of yellow copper guilt, and shewed us that such stuffe came from the said river, and that there be Agojudas, that is as

much to say, an evill people, who goe all armed even to their fingers' ends. Also they shewed us the manner of their armour, they are made of cordes and wood, finely and cunningly wrought together. They gave us also to understande that those Agojudas doe continually warre one against another, but because we did not understand them well, we could not perceive how farre it was to that country. Our capitaine shewed them redde copper, which in their language they call Caquedaze, and looking towarde that countrey, with signes asked them if any came from thence, they shaking their heads answered no; but they shewed us that it came from Saguenay, and that lyeth cleane contrary to the other. After we had heard and seene these things of them we drewe to our boates accompanied with a great multitude of those people; some of them when as they sawe any of our fellowes weary, would take them up on their shoulders, and carry them as on horseback."

The original edition of Cartier's voyages seems to have been illustrated with maps or plans, one of which, representing Hochelaga is extant in the Italian translation by Ramusio, published at Venice, in 1560.* It is a sort of ideal birds-eye view, either taken on the spot, or from subsequent recollection. A reduced copy of the more important parts is given in Fig. 16. It shows the construction of the wooden wall of defence and the form and arrangement of the houses, and gives a rude representation of the character of the surrounding country. It enables us to understand the dimensions of the houses given by Cartier, which evidently refer not to the individual dwellings, which are square, but to rows or blocks of four or five houses. Further it gives as the diameter of the circular enclosure, about 120 yards, and for each side of the square in the centre, about 30 yards. It also shows that the village was situated near to the base of the mountain, which, however, from the point of view being from the south, does not appear in the sketch; and that it had a small stream to the west, and apparently another at a greater distance to the east.

Taking these descriptions of Cartier in connection with the subsequent statements of the Jesuit missionaries, we may I think arrive at the following conclusions respecting the site of Hochelaga.

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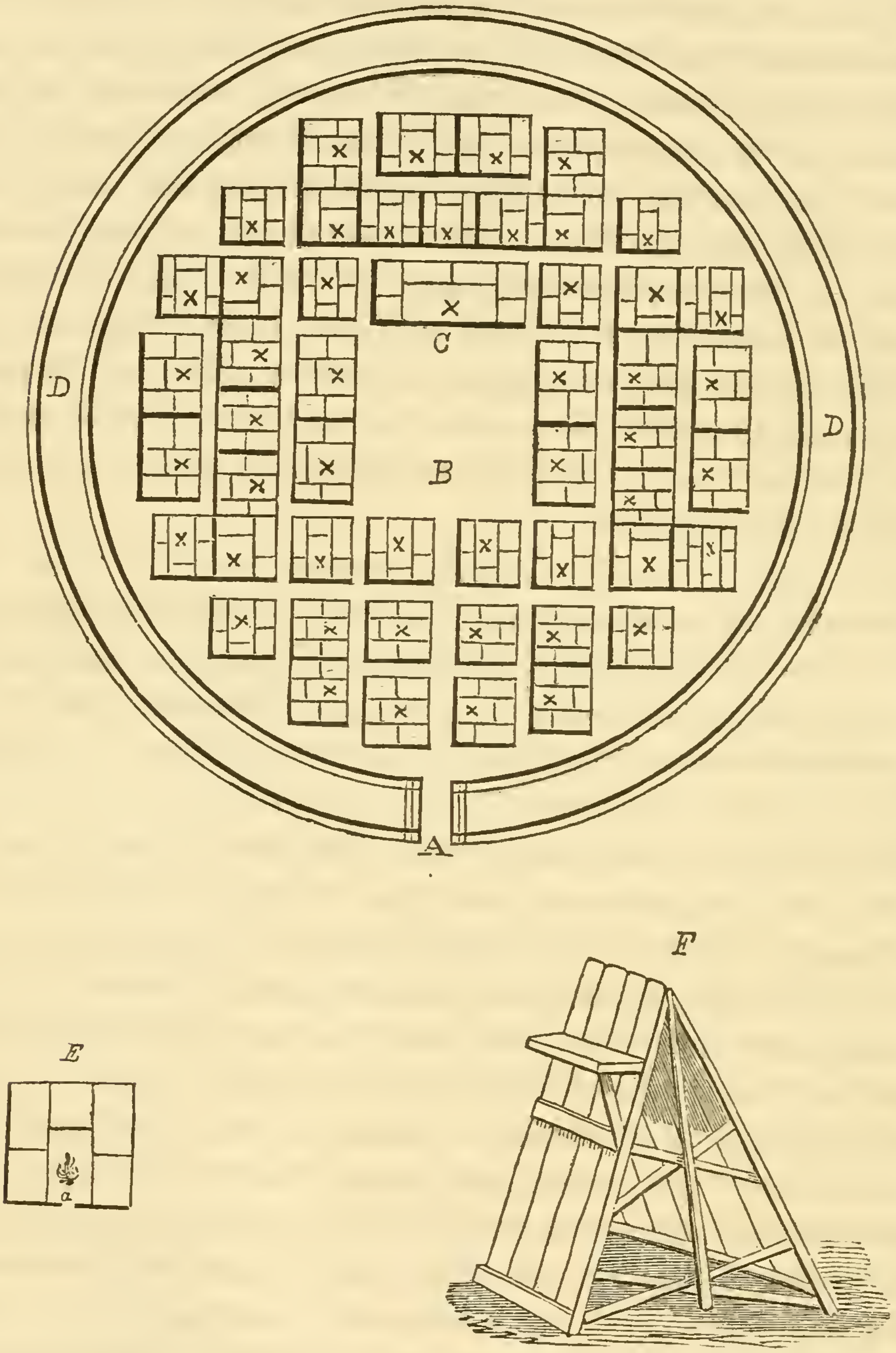
* For an opportunity of consulting this work I am indebted to Rev. H. Verreau, Principal of the Jacques Cartier Normal School.

It was not only distant four or five miles from the place at the foot of the current where Cartier landed, but was at some distance from the river, and on the elevated sandy terrace at the base of the mountain, which is more suitable both to the growth of



Plan of Hochelaga—(Reduced from Ramusio's translation of Cartier.)

a, Gate. *b*, Square. *c*, Chief's House. *d*, Wall of defence. *e*, Plan of a single house, (a) doorway and fire-place. *f*, Section of part of the wall of defence.

oaks, and to the culture of Indian corn as practised by the Indians, than any other part of the island. It was distant about a quarter of a league from the brow of the mountain, and con-

sisted of a dense cluster of cabins about 120 yards in diameter, situated near the eastern side of a small stream or rivulet flowing from the mountain, and in sight of another similar stream lying to the north-east.

All these indications correspond with the site to which these remarks relate ; and if the village was destroyed before 1603, and the wooden structures of which it consisted consumed by fire, no trace of it might remain in 1642, and the ground would probably at that time be overgrown with shrubs and young trees. But the Indian tradition would preserve the memory of the place, and if as there is no reason to doubt, the point of view to which the statement of the Jesuit missionaries relates, was the front of the escarpment of the mountain, their Indian informants would have at their very feet the old residence of their fathers, and their remarks as to the soil and exposure would be specially appropriate, and almost necessarily called forth by the view before them.

I do not maintain that this evidence is sufficient certainly to identify the site, but it is enough when taken in connection with the remains actually found, to induce us to regard this as the most probable site, until better evidence can be found in favour of some other.

The only objection of any weight that occurs to me at present, is the small number of skeletons exhumed. If this spot had been long inhabited, and if the people were in the habit of burying their dead near their dwellings, we might expect to find a more extensive cemetery. But we do not know how long Hochelaga had been in existence in Cartier's time, nor have the excavations made been sufficient to ascertain the actual number of burials. Further, these people may have practised the custom ascribed by Charlevoix to other tribes, of disinterring their dead at intervals of 8 or 10 years, and after a solemn feast for the departed, transferring their remains to a general place of sepulture, often at a distance from their habitations. It is also to be observed that the bodies have been buried in the primitive Indian manner, and are in a condition which would indicate an antiquity quite sufficient to accord with the supposition that they were interred as early as Cartier's visit.

I cannot conclude this article without noticing some general conclusions as to the pre-historic annals of Montreal, which flow from the facts above stated.

1. The aborigines of Montreal were of the Algonquin race.* Cartier evidently represents the languages spoken at Stadacona or Quebec and Hochelaga as identical. Many words which he mentions incidentally are the same or only slightly varied, and he gives one vocabulary for the language of both places. This accords perfectly with the direct statement of the Jesuits' memoirs, that the tribe whose tradition maintained that their ancestors had inhabited Montreal, spoke the Algonquin language both in the time of Cartier and in 1642. These people were also politically and socially connected with the Algonquins of the lower St. Lawrence. Farther the people of Hochelaga informed Cartier that the country to the south-west was inhabited by hostile people, formidable to them in war. These must have been the Hurons or Iroquois, or both. In agreement with this, the Jesuits were informed in 1642, that the Hurons had destroyed the village: that people having formerly been hostile to the Algonquins though then at peace with them.

2. In the time of Cartier the Algonquins of Montreal and its vicinity, were giving way before the Iroquois and Hurons, and shortly after lost possession finally of the island of Montreal. The statement of the two Indians in 1642, implies that at a more ancient period the Algonquins had extended themselves far to the south and west of Montreal. This tradition strikingly resembles that of the Delawares,† that their ancestors allied with the Iroquois had driven before them the Alligewe, a people dwelling like the Algonquins in wooden-walled villages, though the Iroquois had subsequently quarrelled with the Delawares as with the Hurons. The two histories are strictly parallel, if not parts of the same great movement of population. We further learn from the Jesuit Missionaries, that portions of the displaced Algonquin population were absorbed by the Hurons and Iroquois, an important fact to students of the relative physical and social traits of these races.

3. The displacement of the Algonquins tended to reduce them to a lower state of barbarism. Cartier evidently regards the people of Hochelaga as more stationary and agricultural than those farther to the east; and it is natural that a semi-civilized

* They have usually been regarded as Hurons or Iroquois, apparently for no other reason than their settled and agricultural habits.

† The Delawares are themselves regarded as allied to the Algonquin, rather than to the Iroquois race.

people when unable to live in security and driven into a less favourable climate, should betake themselves to a ruder and more migratory life, as the descendants of these people are recorded by the Jesuits to have actually done. If Hochelaga with its well cultivated fields, and stationary and apparently unwarlike population, was only a remnant of multitudes of similar villages once scattered through the great plain of Lower Canada, but destroyed long before the occupation of the country by the French, then we have here an actual historical instance of that displacement of settled and peaceful tribes, which is supposed to have taken place so extensively in America. Our primitive Algonquins of Montreal may thus claim to have been a remnant of one of those old semi-civilized races, whose remains scattered over various parts of North America, have excited so much speculation. Had Cartier arrived a few years later, he would have found no Hochelaga. Had he arrived a century earlier, he might have seen many similar villages scattered over a country occupied in his time by hostile races.

These views are perhaps little more than mere speculation, but they open up paths of profitable inquiry. To what extent was the civilization of the Iroquois and Hurons derived from the races they displaced? What are the actual differences between such remains as those found at Montreal, and those of the Hurons in Upper Canada? Are there any remains of villages in Lower Canada, which might confirm the statements of the two old Indians in 1642?

Into these questions I do not purpose to enter, contenting myself with directing attention to the remains recently discovered in my own vicinity, and which I trust will be collected and preserved with that care which their interest as historical memorials demands. My belief of their importance in this respect, and the desire to rescue from oblivion the last relics of an extinct tribe, must be my excuse for entering on a subject not closely connected with my ordinary studies, but which as an ethnological inquiry, is quite within the sphere of this Journal. J. W. D.

NOTE.—With respect to the great cucumbers and beans mentioned by Cartier, it may be remarked that in the opinion of the late Dr. Harris and of Professor Gray, both of whom have given attention to this subject, the aborigines of Eastern America certainly possessed and cultivated the common pumpkin, some species of squash, and probably two species of beans (*Phaseolus communis and lunatus*), though these plants are not indigenous north of Mexico. Their culture like that of corn and tobacco must have been transmitted to the northern regions from the south.

REVIEWS AND NOTICES OF BOOKS.

Acadian Geology and a Supplementary Chapter thereto.*

The first of the works mentioned in the note at the foot of this page contains the only comprehensive account yet published of the highly interesting and difficult geology of Nova Scotia and the neighbouring regions. This book is too widely known to the geologists of all countries to need any critical examination at the present time. Since its publication the author has removed from the field of his former labours among the carboniferous and New Red sandstone works of Nova Scotia, to the great Silurian plain of Lower Canada. He still labours (as we hope he may long continue to do) to " carry forward " to completion some of the subjects left unfinished in 1855. The results, up to the present time are now published is a neat pamphlet with the title of "Supplementary Chapter to Acadian Geology." It contains a series of condensed articles giving us the recent discoveries and investigations of the author on various points connected with the geology of the Acadian Provinces, such as the Modern and Post Pliocene formations,—and the minerals and fossils of the carboniferous, Devonian and Silurian rocks. We extract an account of some investigations made by Professor How.

" Professor How's paper announces the discovery, in the great bed of gypsum quarried at Windsor, of a rare boracic-acid mineral hitherto found only in Peru.† Its formula, according to Professor How, is—

$$NaO\,2\,BO_3 + 2\,CaO,\,3\,BO_3 + 15\,HO.$$

" With respect to the geological conditions of its occurrence, Professor How quotes from Professor Anderson of Glasgow the

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* 1. Acadian Geology.—An account of the Geological Structure and mineral resources of Nova Scotia and portions of the neighbouring Provinces of British North America. Edinburgh, 1855, 8vo., with a map and illustrations.

2. Supplementary Chapter to Acadian Geology.—12mo. pp. 70. Wood engravings of fossils. By Dr. J. W. Dawson, LL.D., F.G.S. Principal of McGill College, Montreal. Author of Archaia, &c. Edinburgh, 1860.

† Professor How has still more recently discovered a second boracic-acid mineral in the gypsum. It consists of borate and sulphate of lime, soda, and magnesia, and Professor H. proposes to name it Cryptomorphite.

statement that, at Tarapaca in Peru, the mineral is found in a district supposed to be volcanic, and imbedded in the nitrate of soda deposits. He then remarks that, with a very few exceptions, boracic acid is found 'either in directly volcanic regions, most abundantly as such, or as borax: and a well-marked case of actual sublimation of the acid from a volcano in the island of Vulcano, near Sicily, has been studied by Warrington; or in smaller amount, in minerals the products of recent or extinct volcanoes, as Humboldtite from ejected blocks of Vesuvius, and zeolites and datholite from trap of Salisbury Crags, New Jersey, and other places; or in minerals of purely plutonic or metamorphic rocks, as tourmaline, the rhodozite of Roze, and axinite—the species which contain it at all being few in number. It may be noticed also, that traces of this acid have lately been met with in the Kochbrunnen of Wiesbaden and in the waters of Aachen.

"If we may reason from the character of the majority of its situations, we may almost consider the volcanic or at least igneous origin of boracic acid so well established as to lead us, by its occurrence in the gypsiferous strata, to seek for some volcanic agency as the cause of their production. Such an origin has I find already been assigned to the gypsum of Nova Scotia by Mr. Dawson. This formation has been shown to be a member of the Lower Carboniferous series, and is assumed to have arisen from the action of rivers of sulphuric acid more or less dilute, such as are known to exist in various parts of the world, issuing from then active volcanoes and flowing over the calcareous reefs and bed of the sea."'

"This is an interesting confirmation of the views formerly expressed as to the origin of the gypsum; and though Professor Hunt has ably shown, in his recent papers on Chemical Geology,* that gypsum may be produced in stratified masses in aqueous deposits by other processes, I am still inclined, in consequence of the great thickness and local character of the deposits, and the apparent absence of magnesian limestone, as well as the presence of boracic acid, to adhere to the view above stated, in so far as the great gypsum beds of Nova Scotia are concerned."

The following are some of the results of Dr. Dawson's re-

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* Report of Canadian Survey for 1858; Canadian Naturalist; Silliman's Journal, &c.

searches into the origin and composition of the "mineral charcoal," and "compact coal" of the carboniferous system.

"A consideration of the decay of vegetable matter in modern swamps and forests shows that all kinds of tissues are not under ordinary circumstances susceptible of the sort of carbonization which we find in the mineral charcoal. Succulent and lax parenchymatous tissues decay too rapidly and completely. The bark of trees very long resists decay, and, where any deposition is proceeding, is likely to be imbedded unchanged. It is the woody structure, and especially the harder and more durable wood, that, becoming carbonized and splitting along the medullary rays and lines of growth, affords such fragments as those which we find scattered over the surfaces of the coal. These facts would lead us to infer that mineral charcoal represents the woody debris of trees subjected to subaerial decay, and that the bark of these trees should appear as compact coal along with such woody or herbaceous matters as might be imbedded or submerged before decay had time to take place.

"The method of preparing the mineral charcoal for examination was an improvement on the "nitric-acid" process of previous observers, and the results gave very perfect examples of the disc-bearing tissue restricted in the modern world to conifers and cycads, but which existed also in the Sigillariæ of the coal period. With this were scalariform vessels, like those of ferns and club mosses, and several other kinds of woody tissue. On careful comparison it was found that all these tissues might be referred to the following genera of plants common in the coal measures: Sigillaria including Stigmaria, Calamites, Dadoxylon and other conifers, Lepidodendron, Ulodendron, ferns, and possibly some other less known plants.

"Another form of tissue observed was a large spiral vessel, possibly belonging to some endogenous plant.

"The structures preserved in the layers of shining compact coal are more obscure, and I therefore present a somewhat more full summary of the facts known in respect to them :—

"The compact coal, constituting a far larger proportion of the mass than the "mineral charcoal" does, consists either of lustrous conchoidal *cherry* or *pitch coal*,—of less lustrous *slate coal*, with flat fracture,—or of coarse coal, containing much earthy matter. All of these are arranged in thin interrupted laminæ. They consist of vegetable matter which has not been altered by subae-

rial decay, but which has undergone the bituminous putrefaction, and has thereby been resolved into a nearly homogeneous mass, which still, however, retains traces of structure and of the forms of the individual flattened plants composing it. As these last are sometimes more distinct than the minute structures, and are necessary for their comprehension, I shall, under the following heads notice both as I have observed them in the coals in question.

"1. The laminæ of pitch or cherry coal, when carefully traced over the surfaces of accumulation, are found to present the outline of flattened trunks. This is also true, to a certain extent, of the finer varieties of slate coal; but the coarse coal appears to consist of extensive laminæ of disintegrated vegetable matter mixed with mud.

"2. When the coal (especially the more shaly varieties) is held obliquely under a strong light, in the manner recommended by Goeppert, the surfaces of the laminæ present the forms of many well-known coal-plants, as Sigillaria, Stigmaria, Poacites or Cordaites, Lepidodendron, Ulodendron, and rough bark, perhaps of conifers.

"3. When the coal is traced upward into the roof-shales, we often find the laminæ of compact coal represented by flattened coaly trunks and leaves, now rendered distinct by being separated by clay.

"4. In these flattened trunks it is the outer cortical layer that alone constitutes the coal. This is very manifest when the upper and under bark are separated by a film of clay or of mineral charcoal, occupying the place of the wood. In this condition the bark of a large Sigillaria gives only one or two lines in thickness of coal; Stigmaria, Lepidodendron, and Ulodendron give still less. In the shales these flattened trunks are often so crushed together that it is difficult to separate them. In the coal they are, so to speak, fused into a homogeneous mass.

"5. The phenomena of erect forests explain, to some extent, the manner in which layers of compact coal and mineral charcoal may result from the accumulation of trunks of trees *in situ*. In the sections at the south Joggins, the usual state of preservation of erect Sigillariæ is that of casts in sandstone, enclosed by a thin layer of bark converted into compact, caking, bituminous coal, while the remains of the woody matter may be found in the bottom of the cast in the state of mineral charcoal. In other cases the bark has fallen in, and all that remains to indicate the place

of a tree is a little pile of mineral charcoal, with strips of bark converted into compact coal. Lastly, a series of such remains of tumps, with flattened bark of prostrate trunks, may constitute as rudimentary bed of coal, many of which exists in the Joggins section. In short, a single trunk of Sigillaria in an erect forest presents an epitome of a coal-seam. Its roots represent the Stigmaria underclay; its bark the compact coal; its woody axis the mineral charcoal; its fallen leaves, with remains of herbaceous plants growing in its shade, mixed with a little earthy matter, the layers of coarse coal. The condition the durable outer bark of erect trees concurs with the chemical theory of coal, in showing the especial suitableness of this kind of tissue for the production of the purer compact coals. It is also probable that the comparative impermeability of bark to mineral infiltration is of importance in this respect, enabling this material to remain unaffected by causes which have filled those layers consisting of herbaceous materials and decayed wood, with earthy matter, pyrites, &c.

"6. The miscroscopic structure of the purer varieties of compact coal accords with that of the bark of Sigillaria. The compact coals are capable of affording very little true structure. Their cell-walls have been pressed close together; and pseudo-cellular structures have arisen from molecular action and the segregation of bituminous matter. Most of the structures which have been figured by microscopists are of this last character, or at the utmost are cell-structures masked by concretionary action, pressure, and decay. Hutton, however, appears to have ascertained a truly cellular tissue in this kind of coal. Goeppert also has figured parenchymatous and perhaps bast-tissues obtained from its incineration. By acting on it with nitric acid, I have found that the structures remaining both in the lustrous compact coals and in the bark of Sigillariæ are parenchymatous cells and fibrous cells, probably bast-fibres.

"7. I by no means desire to maintain that all portions of the coal-seams not in the state of mineral charcoal consist of cortical tissues. Quantities of herbaceous plants, leaves, &c, are also present, especially in the coarser coals; and some small seams appear to consist entirely of such material,—for instance, of the leaves of Cordaites or Poacites. I would also observe that, though in the roof-shales and other associated beds it is usually only the cortical layer of trees that appears as compact bituminous

coal, yet I have found specimens which show that in the coal-seams themselves true woody tissues have sometimes been imbedded unchanged, and converted into structureless coal, forming like the coniferous trees converted into jet in more modern formations, thin bands of very pure bituminous material. The proportion of woody matter in this state differs in different coals, and is probably greatest in those which show the least mineral charcoal; but the alteration which it has undergone renders it almost impossible to distinguish it from the flattened bark, which in all ordinary cases is much more abundant."

Along the Atlantic coast there is a vast series of slates and quartzites which Dr. Dawson thinks may be a continuation of the Primordial zone of Newfoundland. We are strongly inclined to the belief that this supposition will yet turn out to be well founded. This tract being composed of intensely plicated rocks will be difficult to work, but the discovery of a *Paradoxides* or a *Pulaeopyge* would amply repay the observer for any amount of search. Just now when Darwin's theory is attracting so much attention, any organic thing that can be exhumed from such a vastly ancient resting place must possess an extraordinary interest.

E. B.

Elements of Chemical Physics; by J. P. Cooke, Jr., Irving Professor of Chemistry and Mineralogy in Harvard University. Little, Brown & Co., Boston. 1860.

This work demands commendation for its superiority to the generality of American text books on science. It does not come up to our ideal of a scientific exposition of the subjects on which it treats, and yet it is far in advance of any work upon the same or kindred topics published on this side the Atlantic, and merits and we trust will have large success. Its defects are so to speak necessary. The author has not felt warranted in assuming any more extended acquaintance with mathematics, on the part of his readers, than is implied in a knowledge of the methods of solving simple equations, and a familiarity with the rudiments of geometry. It is obvious that many demonstrations in physics are thereby rendered prolix, and some impossible, so that in this work principles, the legitimate consequences of others previously assumed or demonstrated, have to be established by an appeal to experiment, the process of deduction being too tedious—if not

altogether impracticable—without the aid of more abstruse mathematical processes.

The present volume is the first of a promised series forming a course on the Philosophy of Chemistry. In this volume the author aims to give a complete development of the theory of weighing and measuring. In the rough these operations are simple enough, and intelligible enough; but when as in many chemical investigations, an error of a hundred thousandth is important, minute sources of error have to be guarded against which demand for their elimination a knowledge of physical laws not always possessed by the tyro. When it is remembered that the chemist must correct his first approximation to the weight or volume of the substance with which he experiments for errors arising from the buoyancy of the air, its ever varying pressure, its different degrees of humidity, from changes of temperature of the mass to be computed, as well as of the vessel that contains it, and from many other more refined and occult influences, it is easy to conceive that an extended acquaintance with the laws of motion, with the nature of matter, with hydrostatics, with pneumatics, with thermotics and with other branches of Natural Philosophy is necessary.

The author in the development of the subject has adopted a simple natural arrangement. First he gives a chapter of introductory observations in which, by the way, he attempts with indifferent success to distinguish between chemical and physical changes. The second chapter treats of the general properties of matter and the laws of motion. The third chapter treating of molecular forces, first between homogeneous, and then between heterogeneous molecules, we consider to be the best chapter of the work, giving most valuable information in a clear concise style. The fourth chapter, on heat, contains a large amount of well digested information; we cannot however avoid expressing our surprise that the author of a work like the present should enumerate but "two theories" of the nature of heat as "current among philosophers"—the material theory and the undulatory theory—making no reference to the remarkable dynamical theory of heat that has deservedly attracted so much attention in the last few years. If the fifteen or twenty pages devoted to a description of the steam-engine were compressed into two, and the space thus saved devoted to a discussion of the nature of vapours and gases as illustrated by that theory, we think this por-

tion of the work would have been much better performed. The fifth chapter is on weighing and measuring.

The individual portions of the whole are generally well elaborated. The author is everywhere clear but not always concise. He is sometimes tempted to expatiate unduly on topics not immediately connected with his subject. It must, however, be said that his digressions are usually both pleasing and instructive, and cannot be regretted except for their interference with the unity of his design. The work is one that will well repay perusal, and we trust will be studied and mastered by every student of chemistry. We anticipate with pleasure the appearance of the succeeding volume on Stoichiometry and Chemical Classification. S. P. R.

Salmon Fishing in Canada by a Resident. Edited by Col. Sir James E. Alexander, with Illustrations. London: Longman's. Montreal: B. Dawson & Son.

Those who delight in the pastime of Salmon Fishing in the fine tributaries of the St. Lawrence will find in this Book much, both to instruct and interest them. It is written in a very chaste and pleasing style, and as it abounds in good stories it may be read with interest by all classes of persons. The author is evidently an adept in the piscatory art, and knows how to go about and to enjoy a vacation ramble in the solitary wilds of the Lower St. Lawrence. His descriptions of the natural scenery of the country are good and likely to awaken desires in the reader to escape from the civilized and settled place in which he may live and enjoy the freedom of the waters and the woods.

Were we disposed to be critical we should say that the Sermon with which the Chaplain favours the tourists is rather long, and would be improved by a reduction of its bulk. The latter part might be judiciously left out both for the reputation of the author's divinity, and the comfort of the reader. We quite agree with the Baron in thinking this part to be rather "fishy." The vignettes which are interspersed through the work are sketched with remarkable spirit; and although not very artistic are yet very clever and amusing. The Appendix contains several valuable papers on the natural history of the Salmon, and on its peculiar habits in the Canadian waters and elsewhere. We trust that the publication of this Book by its excellent and obliging author, indicates the beginning of a new era in the treatment of

the game Fishes of our Rivers and Lakes. A good Act has been passed by the Provincial Parliament for their protection; and the Commissioner of Crown Lands is a zealous coadjutor in this praiseworthy object. It is only now necessary that the provisions of the Act be faithfully and vigorously enforced—that farmers and others resident on our Salmon and Trouting Streams should both discourage and denounce all poaching. The inspector of the Salmon and Trout fisheries of the Province has wisely taken steps during the past season to put an end to the wholesale distruction of fish out of season at their spawning beds. It is for the interest of the Province and for every dealer in and lover of these noble fish that these valuable products of our waters should be conserved at seasons where their flesh is really almost poisonous, and they are engaged in multiplying their species at so immense a ratio, as, unless hindered, they are known to do.

For a Winter evening or a Summer holiday this book will be found a most pleasing companion, and we trust that it will meet with many readers. A. F. K.

The Glaciers of the Alps: being a narrative of Excursions and Ascents, an Account of the Origin and Phenomena of Glaciers, and an Exposition of the Physical principles to which then are related. By J. Tyndall, F.R.S., Professor of Natural Philosophy, Royal Institution of Great Britain, with Illustrations. Boston: Ticknor and Fields. Montreal: B. Dawson & Son.

This Book is divided into two parts; the *first* chiefly narrative, and the *second* chiefly scientific. In Part I. the author seeks to convey some notion of the life of an Alpine explorer, and of the means by which his knowledge is acquired. In Part II. an attempt is made to classify such knowledge and to refer the observed phenomena to their Physical causes. This part of the work is written with an evident desire to interest intelligent persons who may not possess any special scientific culture. For their sakes the author dwells more fully on principles than he would have done were he addressing purely scientific readers.

The learned author was led into the investigations which this book contains from the study of slaty cleavage in the Silurian Rocks of Wales. The crystalline theory of Sedgwick and others did not appear to him adequately to account for the phenomena.

He was led in the course of his enquiries, to the study of Forbes's famous work on the Alpine Glaciers. The phenomena observable in these masses of moveable ice led him to suppose that possibly they might afford a solution of the problem of slaty cleavage in rocks. This he endeavours with singular clearness and force to show. The conclusions to which he arrives are, that cleavage in the glaciers at angles to the planes of their surfaces is due to the immense latteral pressure to which they are subjected. This ascertainable fact he applies to the cleavage of stratified rocks at angles to the planes of stratification. The attention of other observers has been directed to the same subject and from experiments and observed facts we are in a fair way of arriving at certain conclusions regarding the nature and causes of slaty cleavage.

This book is written in a fine, frank, manly style. With great simplicity and beauty it combines in a successful manner the popular and scientific in the treatment of its topics. To our youth, and to those of riper years, furnished with the education which our schools and colleges afford, we can recommend this book with confidence that they will find it most interesting and profitable reading. A. F. K.

What may be Learned from a Tree. By HARLAND COULTAS. New York: D. Appleton & Co. Montreal: B. Dawson & Son.

This book is respectfully dedicated to all lovers and friends of nature. The author's intention is to show what may be learned from a tree physically and analogically. He traces its life-history from the first manifestations of vitality in the germinating seed until the period of puberty when it puts forth flowers and fruit; he also considers its phenomena after it has passed its prime; and shows its appointed limits, in virtue of the physiological law which governs the development of its organisms in common with those of all other plants.

The author aims at writing a popular book; he addresses himself to the people,—those who feel life to be one continued strnggle for existence. The style is rather popular and eloquent for our taste, we would prefer greater clearness and simplicity and less diffuseness of style and treatment. The object of the work is creditable, the author's acquaintance with vegetable physiology seems accurate and considerable, and his treatise may be read with much interest and profit.

Unity in Variety, as deduced from the Vegetable Kingdom, being an attempt at developing that oneness which is discoverable in the habits, mode of growth, and principle of construction of all plants. By CHRISTOPHER DRESSER, lecturer on botany &c., South Kensington Museum. London: J. S. Virtue. Montreal: B. Dawson & Son.

This work is the result of a somewhat protracted study of the modes in which vegetable structures increase themselves by growth; the external appearances of plants during their enlargement being carefully considered, as well as the principles upon which their enlargement is dependent. The author's aim is to trace out the oneness of principle which pervades all the works of the floral creation. He deems that this view of the vegetable kingdom greatly simplifies the study of scientific botany in all its branches. The book is not intended for mere beginners but for those who have acquired some knowledge of the elements of botany; and it is believed that the consideration of its contents will conduce to the rapid progress of the student. The author very justly says, that, in order to the prosecution of any branch of botany, nature as well as, and even more than books, must be resorted to. The botanist must live among plants, and daily study their forms, and the principle upon which their growth depends. The book is a fine specimen of typography, and is most copiously illustrated, and that, too, with an artistic skill and beauty never before attempted in an elementary work on botany. We have seen no wood-cut representations of botanical subjects at all equal to these. They are most pleasing to look upon and leave nothing further, in their own department, to be desired. For artists and those who wish to study flower-drawing this book will be invaluable, and to all students of botany, even although they may not agree with the authors speculations, it will yet be of interest.

A. F. K.

MISCELLANEOUS.

"On an undescribed Fossil Fern from the Lower Coal-measures of Nova Scotia." By Dr. J. W. Dawson, F.G.S. (Abstract of a paper read at the meeting of the Geological Society of London, Nov. 7, 1860.)

In a paper on the Lower Carboniferous rocks of British Ame-

rica, published in the 15th volume of the Geological Society's Journal, Dr. Dawson noticed some fragmentary plant-remains which he referred with some doubt, the one to *Schizopteris* (Brongn.) and the other to *Sphæreda* (L. and H.) With these were also fragments of a fern resembling *Sphenopteris* (*Cyclopteris*) *adiantoides* of Lindley and Hutton. Since 1858 the author has received a large series of better-preserved specimens from Mr. C. F. Hart; and from these he finds that what he doubtfully termed the frond of *Schizopteris* is a flattened stipe, and that the leaflets which he referred to *Sphenopteris adiantoides* really belonged to the same plant. Mr. Hart's specimens also show that what Dr. Dawson thought to be *Sphæredæ* were attached to the subdivisions of these stipes, and are the remains of fertile pinnæ, borne on the lower part of the stipe, as in some modern ferns. This structure is something like what obtains in the Cuban *Aneimia adiantifolia*, as pointed out to the author by Professor Eaton, of Yale College. No sporangia are seen in the fossil specimens.

Dr. Dawson offers some remarks on the difficulties of arranging this fern among the fossil *Cyclopterides*, *Nœggerathiæ*, and *Adiantites;* and, placing it in the genus *Cyclopteris*, he suggests that it be recognized as a subgenus (*Aneimites*) with the specific name *Acadica*.

The regularly striated and gracefully branching stipes, terminated by groups of pinnules on slender petioles, must have given to this fern a very elegant appearance. It attained a great size. One stipe is 2 inches in diameter, where it expands to unite with the stem; and it attains a length of 21 inches before it branches. The frond must have been at least 3 feet broad. The specimens are extremely numerous at Horton.

The author then notices that the long slender leaves so common in the Coal-measures of Nova Scotia, and hitherto called *Poacites*, though sometimes like the stipes of *Aneimites*, are probably leaves of *Cordaites*.

On some specimens of *Aneimites Acadica*, markings like those made by insects have been observed; also a specimen of the *Spirorbis carbonarius*.

Note on a specimen of Neaera, *Collected by Mr. R. S. Fowler, and Exhibited to the Natural History Society.*

This specimen was obtained from the stomach of a Flounder at

Portland. It is of the size of the *Neaera cuspidata* of Great Britain and much resembles it in form, but is less gibbous and thinner and has the teeth less developed. Still these differences are hardly more than sufficient to constitute a well marked variety. The *N. pellucida* obtained by Stimpson in 40 fathoms off Long Island, is probably the young of the species to which Mr. F's shell belongs; and as Stimpson's specimen is the only one heretofore recorded as found on the American coast, the present specimen is of much interest.*

J. W. D.

Note on Relics of the Red Indians of Newfoundland, Collected by Mr. Smith McKay, and Exhibited to the Natural History Society.

These objects were found in a sepulchral cave in the southern part of Newfoundland, with the remains of a body wrapped in birch bark and stated by the modern Indians to have been probably a "Medicine Man." They consist of a portion of a walrus tusk, cut across by a sharp instrument, three flat pendants of elongated triangular form of the same material, and ornamented with lines and dots forming various patterns, shell wampum finished and in various stages of manufacture, with portions of the unformed shells, small univalve shells perforated so as to be strung as beads or attached to wearing apparel, portions of an iron knife or dagger and of a hatchet completely oxidised, and the wooden stem of an arrow, with a stone head very rudely formed These relics must belong to the earlier portion of the intercourse of the Red Indians with Europeans. They resemble the objects found in graves of other tribes, the principal peculiarities being the use of the ivory of the walrus tusk, and the circumstance that the wampum is made of the shell of a large *Mactra* probably *M. solidissima.*

J. W. D.

KINGSTON BOTANICAL SOCIETY.

It is with much pleasure that we notice the formation of a vigorous Botanical Society in Kingston, in connection with

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* Since the above was written, Mr. Stimpson has seen the specimen and regards it as the adult of *N. pellucida*, and distinct from *N. cuspidata.*

Queen's College under the auspices of the Principal and Professors. Professor Lawson, whose name as a botanist is already widely known, has evidently been the initiator of this movement, and will we doubt not prove the soul of the Society itself. His practical knowledge of botanical subjects and his genuine scientific enthusiasm, will we hope be the means of carrying on the society's affairs with efficiency, and of infusing into the minds of its younger members a zeal for the prosecution of this noble department of science. We hope from time to time to be able to report good work done in the way of original research and discovery in the fine region of country which lies around Kingson. Among other departments we trust that this Society will draw attention to the fine array of forest trees which our country contains, not so much for purposes of commerce as for purposes of preservation and economical use at home. The Canadian farmer has not yet learned the wisdom of planting as he has of cutting down trees, and the time seems not far distant when in many of the finest parts of the country the famous forestry of Canada will have disappeared from our sight. This Society has much work before it which we trust it will not only begin but carry out with effect. Our readers will be interested in the following extracts from Professor Lawson's admirable address.

"Dr. Lawson pointed out the peculiar sphere in which the botanist is called to labour, the range of his studies, and the means acquired for their pursuit. It is of great importance that at the outset the real object of our proposed Society should be understood. The establishment of a Botanical Garden and other appliances must be regarded as secondary to the great object of the Society, the prosecution of scientific botany. Botany is at a low ebb in Canada, at a lower ebb than in most civilized or half civilized countries on the face of the earth. At the close of the eighteenth century, only five dissertations, on botanical subjects had been published by the whole medical graduates of the great Continent of America. Since then the indefatigable labours of such men as Michaux, Pursh, Torrey, Harvey, Curtis, Boott, Englemann, Tuckermann Sullivant, Lesquereux, and especially of one whose name and fame rise above all the rest, Asa Gray, have brought our knowledge, of the botany of the United States on a level with that of the best botanized countries of Europe. The Flora of Canada has also been elaborated since then by one who still presides over the destinies of botanical science, not in England alone, for

his authority is recognised wherever the science is pursued. But during a period of nearly thirty years very little has been added to our published knowledge of Canadian botany. Information respecting our indigenous plants must still be sought in the work of Sir William Hooker, issued from the Colonial office in England in 1833. That work founded as it necessarily was, on dried specimens carried home by passing travellers, afforded to the botanical world an admirable example of how much could be made out of slender material when in good hands. Unimpeachable as a work of science, unsurpassed in the whole range of botanical literature in the accuracy and beauty of its illustrations, the *Flora Boreali-Americana* afforded the means of developing still more fully a knowledge of the Canadian Flora. The North American Flora of Torrey and Gray and the Manual of the Botany of the Northern States, offered additional temptations, to the pursuit; but advances have not been made commensurate with the advantages that were offered; we have still, therefore, the singular anomaly of a country distinguished by its liberal patronage to science, dependent for its information respecting its native plants on the descriptions of specimens culled by early travellers. What was thirty years ago, and is now, of the highest value, can only in a partial manner meet the wants of the country in these days, when new manufactures and new forms of industry, seeking new products to work upon, are daily springing up around us. We desire to place the science of Botany on a more satisfactory footing in Canada than that which it now holds; we desire to increase the existing stock of knowledge; we desire to diffuse a taste for the study, so as to add to the number of laborers now in the field; and we desire to place on record new observations and discoveries, as they arise. The Botanical Society is designed as a means for carrying out purposes such as these. Extensive circulation was given sometime ago by Canadian newspapers to a report that Sir William Hooker was on his way to Canada with a staff of assistants to explore the botany of the country. I have the best authority for stating that that report was without foundation. It probably originated in certain proposals that were made to the Colonial office regarding the publication of a series of popular Manuals of Colonial Botany; but no expedition was ever contemplated by Sir Wm. Hooker, or any one else, at the instance of the Government. On the contrary, recent communications from the botanical advisers of the Home Government indicate that

Canada must follow the salutary example of other old established British Colonies, and conduct for herself investigations into the nature and distribution of her indigenous productions. We already possess in Canada several important scientific societies in active operation. While the Canadian Institute is of a comprehensive character, embracing all branches of science, literature and philosophy, the special department of geology is amply cultivated by the Natural History Society of Montreal, which has also, however, made valuable contributions to zoology and botany. In addition to such institutions as these, we have, of still more special character, the Government Geological Survey, which has been instrumental in carrying out investigations of the greatest importance to the country, whether their results be viewed as intellectual achievements, or as contributions to material industry. It is proposed that our Society shall have for its object the advancement of Botanical Science in all its departments—Structural, Physiological, Systematic and Geographical; and the application of Botany to the useful and ornamental arts of life. The means by which this object may be accomplished are various, and will come before us for discussion from time to time. In the meantime, it is proposed that there shall be monthly evening meetings in Kingston, during the winter for the reading of papers, receiving botanical intelligence, examining specimens, and discussing matters of scientific interest in relation to the science; also that there shall be field meetings during the summer in distant localities in Canada, as well as in the other British Provinces of North America, and occasionally also in the adjoining States, whereby our members may have an opportunity, of investigating the botany of districts that have been imperfectly examined. By the above and similar means, much important information may be brought together. Such facts and results, new to science, as are laid before the Society, from time to time, will afford materials for the publication of "Transactions," whereby our stores may be rendered available to the public in Canada, and to botanists in other parts of the world. In addition to such means, the Society may greatly promote its objects by correspondence with botanists in other countries, and especially with those who are located beside the extensive public herbaria, botanical libraries, and gardens, in various parts of the United States and Europe. By correspondence with such persons, many doubtful points on nomenclature may be set at rest, while the existence of information relating

to Canadian Botany, may be ascertained that might otherwise remain unknown. Botanists distinguished in certain branches of the science may be called upon to furnish reports on their special subjects, for which materials may be brought together by the members. Such aid will be of the greatest value to the Society, and I have, therefore, gratification in informing you that communications, have already been received from some of the most active Botanists, in the United States, England, Scotland, and Prussia promising cordial co-operation. So soon as preliminary operations enable us to proceed to the discussion of scientific business you will also have an opportunity of ascertaining that we already have observers throughout the length and breadth of Canada, as well as in the other North American Provinces, from the Red River in the far west, to the Island of Prince Edward in the East. In common with the botanists of other countries we must necessarily take cognizance of those discoveries in structural and physiological botany which are daily challenging a careful examination. But our position in a comparatively new country points out to us a special path of research which it will be our duty to follow—that which has for its object the investigation of the special botany of Canada, the geographical and local distribution of the plants. The indigenous plants whose products are now used or are capable of being applied to the useful arts, will deserve a large share of attention, and no doubt regard will also be had to those, that are suited to our climate but have not yet been introduced. Strewed around her path in the woods and on the shores of our lakes are many plants capable of yielding food and physic, dyeing and tanning materials, oils, fibers for spinning, and paper making, &c. Even in the midst of the city of Kingston, growing on vacant lots, and in court yards, there are drug plants enough to stock a Liverpool warehouse. Such will no doubt be brought into use when better known, and thus an increase, will be effected in the production of the country.

"While leaving to other Societies the discussion of the more general questions of science and to special Societies their peculiar topics, we propose to employ the Botanical Society as an instrument for the collection of facts and the working out of details which are of immediate interest to the botanist alone, but of the greatest importance in leading to correct results in general science. Scientific Societies on a broader basis have too often

degenerated into popular institutions, calculated rather for the amusement of the many than for the encouragement and aid of the few who are engaged in the prosecution of original discovery. We shall be guarded against such a result, in a great measure by the special object of our Institution, but it will be needful, also, while we attempt to spread a taste for Botany, and to diffuse correct information as to its objects, its discoveries and its useful applications, that we should seek rather to bring our members and the public into scientific modes of thought and expression than to allow our Society to yield up its scientific character to suit the popular taste. There is much reason to believe that the want of an organization of this kind, whose duty is to collect and record facts and discoveries, has been the means of losing to science materials of great value. There have been casual residents in Canada, at different times, who have made collections of greater or less extent and who have in some cases, carried out special investigations in Botany without leaving any printed record of their labours. Some of these may still be rescued from oblivion; but there are also other observations, and discoveries made by present residents in the country which, we may confidently hope, will be made available to the Society's purposes.

"The objects sought by the establishment of a Botanical Society in this country are of great importance, both in a scientific and economical point of view. The field is broad and the soil is rich. The extent to which we can cultivate will depend entirely upon the number of the laborers, and the zeal and industry which they display. Let us therefore not be disappointed with our first results. Let us lay a foundation and persevere in the work and workers will gather around us as they have done before in the Botanical Societies of other countries. To organizations of this kind more than to any other means, are we indebted for the advanced state of botanical science, at this day; and in a country such as this, it is especially needful to have a wide spread organization in order to elicit satisfactory results. In an attempt to organise a Society such as this, we may confidently appeal to many classes of the community. The theologian, and moralist see in the vegetable kingdom a display of the power and wisdom and goodness of our Creator, and beautiful types of spiritual teaching; the medical man recognises in it, the source of his most potent drugs; the sanitary reformer knows, that the simpler forms of vegetation are often the cause, and more frequently the index of

more widely spread diseases; the lawyer finds in the microscopical structure of vegetable products a ready means of detecting frauds, adulterations and poisonings; the commercial man recogizes the value of a science having such bearings, and directly devoted to the extension of the sphere of industry; the spinner and paper maker, must here obtain their knowledge of the mechanical condition of vegetable fibres; the farmer, the gardener the orchardist, the vine-grower, the brewer, the dyer, the tanner, and the lumberman, must all apply to botany for an explanation of matters that daily come before them in their various avocations. As an utilitarian institution then our Society is worthy, and will no doubt receive warm support; but it is to be hoped that many zealous laborers will enter the field from higher motives—a desire to promote the cause of science."

The Rev. Principal Leitch reviewed some of the leading points brought forward in the addresses, and referred briefly to some of the more important advantages that might accrue to the country from an institution such as the one that had been proposed, alluding especially to the inducements which it would give to botanical research. Dr. Lawson, he said, when enumerating the grounds for the establishment of a Botanical Society, omitted the weightiestof all, viz, that we can count upon his services. Without his large and valuable experience in the management of such societies I fear we would have little heart to carry out the scheme. He for a long period acted as Secretary to the Edinburgh Botanical Society—one of the most active in the world; and from his accurate knowledge of the details of management, and his well merited distinction in botanical science, he is qualified in no ordinary measure for organizing such a society as the one we contemplate. The labour will fall chiefly upon his shoulders, but we must pledge ourselves to lend him every assistance in our power.

Communications for the Society are to be addressed to Prof. Lawson, Kingston, Canada West.

The Liverpool Naturlists Field-Club held their first meeting on Saturday last under favourable and auspicious circumstances. About uinety-five ladies and gentlemen met at the landing-stage and proceeded thence to Bromborow, in Cheshire one of the most

interesting localities about Liverpool for the study of Natural History. Arrived there they divided into parties of about thirty each, to explore the neighbourhood. One division was lead by a geologist qualified to explain the nature of the surrounding strata; another by two or three proficient botanists; and the third by a gentelman whose name is known to the students of microscopical science. After rambling about and investigating the natural curiosities of the neighbourhood (during which time many curious specimens were obtained), the parties met at a charming little spot in the vicinity called Raby Mere, and partook of a homely but plentiful tea in a garden attached to a farmhouse. At this stage of the proceedings a prize was awarded according to previous arrangement, to a young lady, for the greatest variety of wild flowers collected during the ramble; and several beautiful specimens of plants and insects, as well as a fine viper, were examined by the excursionists with interest. A Commettee meeting was then held in the open air, when it was determined to offer a prize on the occasion of each excursion; the next field meeting was fixed and a great many new members were proposed. The Society already numbers nearly 200 members and promises to be the most extensive of the kind in England. The eqcursionists returned home delighted with their days ramble. We may mention for the government of other clubs of this kind, that more that the third of those present were ladies, who were deeply interested in all the proceedings.—*Athenæum.*

New form of Microscope.

'On Microscopic Vision, and a New Form of Microscope,' by Sir D. Brewster.—In studying the influence of aperture on the images of bodies as formed in the camera, by lenses or mirrors, it occurred to me that in microscopic vision it might exercise a still more injurious influence. Opticians have recently exerted their skill in producing achromatic object-glasses for the microscope with large angles of aperture. In 1848 the late distinguished optician, Mr. Andrew Ross, asserted "that 135° was the largest angular pencil that could be passed through a microscopic object-glass," and yet in 1855 he had increased it to 170°! while some observers speak of angular apertures of 175°. In considering the influence of aperture, we shall suppose that an achromatic object-glass with an angle of aperture of 170° is optically perfect, repre-

senting every object without colour and without spherical aberration; when the microscopic object is a cube, we shall see five of its faces, and when it is a sphere or a cylinder, we shall see nine-tenths or more of its circumference. How then does it happen that large apertures exhibit objects which are not seen when small apertures with the same focal length are employed? This superiority is particularly shown with test objects marked with grooves or ridges and obliquely illuminated. The marginal part of the lens will enlarge the grooves and ridges, and they will thus be rendered visible, not because they are seen more distinctly, but because they are expanded by the combination of their inco-incident images. Hence we have an explanation of the fact—well known to all who use the microscope,—that objects are seen more distinctly with object-glasses of small angular aperture. In the one case we have, with the same magnifying power, not only an enlarged and indistinct image of objects, but a false representation of them, from which their true structure cannot be discovered; while in the other we have a smaller and distinct image, and a more correct representation of the object. But these are not the only objections to large angular apertures and short focal lengths. 1. In the first place, it is extremely difficult to illuminate objects when so close to the object-glass. 2. There is a great loss of light, from its oblique incidence on the surface of the first lens. 3. The surface of glass,—with the most perfect polish,—must be covered with minute pores, produced by the attrition of the polishing powder; and light, falling upon the sides of these pores with extreme obliquity, must not only suffer diffraction, but be refracted less perfectly than when incident at a less angle. 4. When the object is almost in contact with the anterior lens, the microscope is wholly unfit for researches in which mechanical operations are required, and also for the examinations of objects inclosed in minerals or other transparent bodies. 5. In object-glasses now in use, the rays of light must pass through a great thickness of glass of doubtful homogeneity. It is a question yet to be solved whether or not a substance can be truly transparent, in which the elements are not united in definite proportion; in which the substances combined have very different refractive and dispersive powers; and in which the particles are so loosely united that they separate from one another, as in the various kinds of decomposition to which glass is liable. If the best microscopes are effected by these sources of error, every exertion should be made to diminish or remove them.

1. The first step, we conceive, is, to abandon large angular apertures, and to use object-glasses of moderate focal length, obtaining at the eye-glass any additional magnifying power that may be required. 2. In order to obtain a better illumination, either by light incident vertically or obliquely, a new form of the microscope would be advantageous. In place of directing the microscope to the object itself, placed as it now is almost touching the object-glass, let it be directed to an image of the object, formed by the thinnest achromatic lens, of such a focal length that the object may be an inch or more from the lens, and its image equal to, or greater, or less than the object. In this way the observer will be able to illuminate the object, whether opaque or transparent, and may subject it to any experiments he may desire to make upon it. It may thus be studied without a covering of glass, and when its parts are developed by immersion in a fluid. 3. The sources of error arising from the want of perfect polish and perfect homogeneity of the glass of which the lenses are composed, are, to some extent, hypothetical; but there are reasons for believing,—and these reasons corroborated by facts,—that a body whose ingredients are united by fusion, and kept in a state of constraint from which they are striving to get free, cannot possess that homogeneity of structure, or that perfection of polish, which will allow the rays of light to be refracted and transmitted without injurious modification. If glass is to be used for the lenses or microscopes, long and careful annealing should be adopted, and the polishing process should be continued long after it appears perfect to the optician. We believe, however, that the time is not distant when transparent minerals, in which their elements are united in definite proportions, will be substituted for glass. Diamond, topaz, and rock crystal are those which appear best suited for lenses. The white topaz of New Holland is particularly fitted for optical purposes, as its double refractions may be removed by cutting it in plates perpendicular to one of its optical axes. In rock crystal the structure is, generally speaking, less perfect along ths axis of double refraction than in any other direction, but this imperfection does not exist in topaz.—Prof. Stokes and Mr. Stoney suggested some modifications of Sir David Brewster's theoric views; and a member of the Section whose name we did not catch, stated that several attempts had been made to form an image of objects more removed from the first or object glass of the microscope than at present, by using an additional lens, but hitherto without success.

CORRESPONDENCE.

Remarks on the Fauna of the Quebec Group of Rocks, and the Primordial Zone of Canada, addressed to Mr. Joachim Barrande. By SIR W. E. LOGAN, Director of the Geological Survey of Canada.

MONTREAL, 31st Dec., 1860.

MY DEAR MR. BARRANDE,

I am much indebted to you for your letter of the 6th August, which was accompanied by a copy of your communication to Professor Bronn of Heidelberg, dated 16th July. Agreeably to your request, I took an early opportunity of letting Mr. Hall have a copy of your communication to Prof. Bronn, and he received it on the 11th or 12th September.

I am of course aware, from the correspondence you have had with my friend Mr. Billings and myself, how far you are acquainted with our discoveries at Quebec. On two occasions, just previous to the receipt of your last letter to Mr. Billings (received the 8th November), I devoted the short time I could spare from other engagements connected with the Geological Survey, to farther researches at Point Levi. I have satisfied myself, notwithstanding the conglomerate aspect of the bands of rock which contain our new fossils, that the fossils are of the age of the strata. Without entering at present on minute details of structure, I may say that the chief part of the specimens, found up to this time, are from two parallel out-crops, which might be taken as representing two distinct layers. If they are such, they are comprehended in a thickness of about 150 feet; but the circumstances of the case, connected with the physical structure, make it probable that the one band is a repetition of the other through the influence of an anticlinal fold or a dislocation. Both outcrops dip to the south-eastward.

From the more northern out-crop (which we shall call A^2) we have obtained *Orthis* 1, *Leptæna* 1, *Camerella* 1, *Lingula* 2, *Discina* 1, *Agnostus* 3, *Conocephalites* 1, *Arionellus* 4, *Dikelocephalus* 6, *Bathyurus* 4. From the more southern out-crop (which we shall call A^3) we have *Dictyonema* 1, *Orthis* 2, *Leptæna* 1, *Strophomena* 1, *Camerella* 1, *Cyrtodonta* (?) 1, *Murchisonia* 3, *Pleurotomaria* 7, *Helicotoma* 2, *Straparollus* 2, *Capulus* 2,

Agnostus 1, *Bathyurus* 4, *Cheirurus* 2, *Amphion* 2. From a third out-crop, which is still farther southward, and supposed to be another repetition of the same band (which we shall call A^4), we have *Orthis* 1, *Camerella* 1, *Asaphus* (*A. Illœnoides*) 1, *Bathyurus* 1. Tracing A^2 or A^3 round the extremity of a synclinal, and finding occasional indications of the fossils of A^2 and A^3, we arrive at a position on the south side of the synclinal. We shall call the position P. Here the band A^2 or A^3 ends, but a bed of sandstone a little above it is traceable over an anticlinal to a junction with a conglomerate band lower than A^2 or A^3, shewing that A^2 or A^3 must merge into it. Call this A^1. In this we have *Asaphus* (*A. Illœnoides*) 1, *Menocephalus* (*M. globosus*) 1. These two species occur in the same fragment of rock. Of all these fossils, 1 *Orthis* is common to A^2, A^3 and A^4 ; 1 *Leptœna*, 1 *Camerella*, 1 *Lingula*, 1 *Agnostus*, and 1 *Bathyurus*, are common to A^2 and A^3 ; 1 *Asaphus* is common to A^3 and A^1.

The dip at P is to the south-eastward, and therefore an inverted dip. North-west of this, and therefore above it, at such a distance as would give a thickness of between 200 or 300 feet, we have a band of shale with nodules of limestone, the nodules made up of other rounded masses in a matrix holding fossils, many of them silicified. From a few of these compound nodules we have obtained *Orthis* 11, *Leptœna* 1 ; this band we shall call B^1. A band like this occurs about half a mile or more to the south-westward. It may be a higher band, or it may be the same band, but we shall call it B^2. From this we obtain *Crinoidœa* (columns) 3, *Orthis* 1, *Camerella* 1, *Nautilus* 1, *Orthoceras* 1, *Leperditia* 1, *Trilobites* (2 genera undetermined) 2. In another position to the south-east, on the south-east of the same anticlinal previously mentioned, we meet with a conglomerate band supposed to be the same as B^2 ; but, in case it should be different, we shall call it B^3. Here we have *Orthis* 3, *Pleurotomaria* 2, *Murchisonia* 1, *Ophileta* 1, *Helicotoma* 1, *Nautilus* 1, *Maclurea* 1, *Orthoceras* 3 or 4, *Cyrtoceras* 1, *Bathyurus* 1, *Illœnus* 2, *Asaphus* 1. Of all these fossils. 1 *Orthis* and 1 *Camerella* are common to B^1 and B^2; the same *Orthis* and *Camerella* with 1 *Leptœna* are common to B^1, A^4, A^3 and A^2.

To the north of all these exposures, and on the north-west side of a synclinal running parallel with the synclinal already mentioned, fossils have been obtained in a cliff of about 100 feet, composed of limestone conglomerate, thin bedded limestones and shales.

Their equivalence is not yet quite certain, but the strata are supposed to be not far removed from A[1] and A[2]. We shall call this cliff A. The fossils from it are *Tetradium* 1, *Orthis* 1 *Lingula* 2, *Trilobites* (genus undescribed) 1, with a great collection of compound *Graptolidæ*, described and being described by Mr. Hall under the genera *Graptolithus* 25, *Retiolites* 1, *Reteograptus* 2, *Phyllograptus* 5, *Dendrograptus* 3, *Thamnograptus* 3, *Dictyonema*, 3.

I have given you these details of localities, because as the subject requires further investigation we do not yet wish to commit ourselves entirely as to the equivalency of separate exposures. But there is no doubt that the whole is one group of strata deposited under one set of alternating circumstances. The whole fauna, as known up to the present time, is composed of—

Articulata,	36	species.
Mollusca,	55	"
Graptolidæ,	42	"
Radiata,	4	"
	137	

Of this fauna not one species is found in the Anticosti group, where we have a gradual passage from the fauna of the Hudson River formation to that of the Clinton, and not one of any formation higher than the Chazy. Mr. Billings recognises one species, *Maclurea Atlantica* (Billings) as belonging to the Chazy, and six species as belonging to the Calciferous. They are *Lingula Mantelli* (Billings), *Camerella* undescribed, *Ecculiomphalus* undescribed, *Helicotoma uniangulata* (Hall), *H. perstriata* (Billings), and one remarkable species of an undetermined genus, like a very convex *Cyrtodonta*, which occurs both at Mingan and Point Levi. All of the forms, particularly the trilobites, remind the observer of those figured by Mr. Dale Owen from the oldest fossiliferous rocks of the Mississippi valley, while independent of the six species identical with Chazy and Calciferous forms, there are many others closely allied to those found in the latter formation in Canada.

From the physical structure alone no person would suspect the break that must exist in the neighbourhood of Quebec, and without the evidence of the fossils, every one would be authorized to deny it. If there had been only one or two species of an ancient type, your own doctrine of colonies might have explained the matter,

but this I presume would scarcely be applicable to so many identities in a fauna of such an aspect. Since there must be a break, it will not be very difficult to point out its course and its character. The whole Quebec group, from the base of the magnesian conglomerates and their accompanying magnesian shales to the summit of the Sillery sandstones, must have a thickness of perhaps some 5000 or 7000 feet. It appears to be a great development of strata about the horizon of the Chazy and Calciferous, and it is brought to the surface by an overturn anticlinal fold with a crack and a great dislocation running along the summit, by which the Quebec group is brought to overlap the Hudson River formation. Sometimes it may overlie the overturned Utica formation, and in Vermont points of the overturned Trenton appear occasionally to emerge from beneath the overlap.

A series of such dislocations traverses eastern North America from Alabama to Canada. They have been described by Messieurs Rogers, and by Mr. Safford. The one in question comes upon the boundary of the Province not over a couple of miles from Lake Champlain. From this it proceeds in a gently curving line to Quebec, keeping just north of the fortress; thence it coasts the north side of the Island of Orleans, leaving a narrow margin on the island for the Hudson River or Utica formation. From near the east end of the island it keeps under the waters of the St. Lawrence to within eighty miles of the extremity of Gaspé. Here again it leaves a strip of the Hudson River or Utica formation on the coast.

To the south-east of this line the Quebec group is arranged in long narrow parallel synclinal forms with many overturn dips. These synclinal forms are separated from one another on the main anticlinals by dark grey and even black shales and limestones. These have heretofore been taken by me for shales and limestones of the Hudson River formation, which they strongly resemble, but as they separate the synclinals of the Quebec group must now be considered older. I am not prepared to say that the Potsdam deposit in its typical form of a sandstone is anywhere largely developed above these shales, where the shales are in greatest force. Neither am I prepared to assert its absence, as there are in some places masses of granular quartzite, not far removed from the magnesian rocks of the Quebec group, which require farther investigation; but, from finding wind-mark and ripple-mark on closely succeeding layers

of the Potsdam sandstone where it rests immediately upon the Laurentian series, we know that this arenaceous portion of the formation must have been deposited immediately contiguous to the coast of the ancient Silurian sea, where part of it was even exposed at the ebb of tide. Out in deep water the deposit may have been a black partially calcareous mud, such as would give the shales and limestones which come from beneath the Quebec group.

In Canada no fossils have yet been found in these shales, but the shales resemble those in which *Oleni* have been found in Georgia (Vermont). These shales appear to be interposed between eastward dipping rocks equivalent to the magnesian strata of the Quebec group, and they may be brought up by an overlapping anticlinal or dislocation. We are thus led to believe that these shales and limestones, which may be subordinate to the Potsdam formation, will represent the true primordial zone in Canada.

Mr. Murray has this season ascertained that the lowest rock that is well characterized by its fossils in the neighbourhood of Sault Ste. Marie, near Lake Superior, really belongs to the Birdseye and Black River group, and that it rests on the sandstones of Ste. Marie and Lacloche, the fossiliferous beds at the latter place being tinged with the red color of the sandstone immediately below them. These underlying Lake Superior rocks may thus be Chazy, Calciferous, and Potsdam, and may be equivalent to the Quebec group and the black colored shales beneath. The Lake Superior group is the upper copper-bearing series of that region, and rests uncomformably upon the lower copper-bearing series, which is the Huronian system. The upper copper-bearing series holds nearly all the metals, including gold, and so does the Quebec group, each making an important metalliferous region. Each when unmetamorphosed holds a vast collection of red colored strata. The want of fossils in the Lake Superior group makes it difficult to draw lines of division, but if any part represents the primordial zone, I should hazard the conjecture that it is the dark colored slates of Kamanistiquia, which underlie all the red rocks.

Professor Emmons has long maintained, on evidence that has been much disputed, that rocks in Vermont, which in June 1859 I for the first time saw and recognized as equivalent to the magnesian part of the Quebec group, are older than the Birdseye formation; the fossils which have this year been obtained at Quebec pretty clearly demonstrate that in this he is right. It is at the same time satisfactory to find that the view which Mr. Billings

expressed to you in his letter of the 12th July, to the effect that the Quebec trilobites appeared to him to be about the base of the second fauna, should so well accord with your opinions; and that what we were last spring disposed to regard at Georgia as a colony in the second fauna, should so soon be proved, by the discoveries at Quebec, to be a constituent part of the primordial zone.

I am, my dear Mr. Barrande,

Very truly yours,

W. E. LOGAN.

Mr. Joachim Barrande, Rue Mézière, No. 6, Paris.

List of Donations to the Library and Museum of the Natural History Society of Montreal, from 1*st June*, 1859, *to* 3*rd October*, 1860.

Continuation of Report from Page 230.

Donors' Names.	Donations.
Mr. James Milne	The Annual of Scientific Discovery for 1851, 1852 and 1853.
G. D. Watson, Esq.....	Dictionnaire des Arbitrages des Changes. 2 vols.
Mrs. Ramsay..........	Papers relating to the Nat. History Society.
Geo. Molson, Esq......	Travels in Upper and L. Egypt, by Tourrens.
Lady Franklin.........	Fourth number of the Meteorological Papers published by the Board of Trade.
East India Company....	Bombay Meteorological Register for 1859.
Essex Institute........	Series of their Historical Collections.
Society of Antiquaries, of Copenhagen.......	Transactions of the Societé Royale des Antiquaries du Nord.
Wm. Spink, Esq.......	Geological Reports.
	Statutes of Canada, 1860.
	Exploration of Red River, by Professor Hind.
	Appendices to the Journals of the Legislature. 5 vols.
The Authors...........	The lower Coal Measures as developed in British North America, by Dr. Dawson.
	On the Silurian and Devonian Rocks of Nova Scotia, by Dr. Dawson.
	Description of Canadian Fossils, by Prof. James Hall, Albany.
	Notes on the Coal Fields of Pictou, by Henry Poole.
	New localities of Silurian Fossils in Nova Scotia, by Rev. Dr. Honeyman.
	The Natural History of Washington Territory from the Smithsonian contributions to knowledge.

LIST OF DONATIONS.—*Continued.*

DONORS' NAMES.	DONATIONS.
Lyceum of Natural History, New York......	Their Annual Nos. 1, 3, 8, 9, 10 and 13.
Boston Nat. Hist. Society	Their proceedings.
The Publisher..........	British American Journal.
	Journal of the Canadian Institute.
S. Jones Lyman........	Specimen of Striped Bill-Fish. (*Lepidosteus.*)
	Do. Spider Crab.
	Do. Lepidosteus.
John Leeming, Esq.....	Do. the Peleated Woodpecker.
	A live specimen of the Soft Shelled Turtle. (*Aspidonectes spinifer.*)
James Ferrier, jr , Esq..	A Sebright Bantam.
	A Java Sparrow.
	A Red-breasted Merganser.
John Leeming, Esq	Two Busts of Scott and Byron.
Thomas Keefer, Esq.....	Three Silver Coins found in building the Lock and Dam at St. Ours, in 1851.
A. Wurtele, Esq.......	Specimen of Wood gnawed by Beavers.
Dr. Dawson............	Specimens of Lepas and Balanus found in dredging at Portland.
Dr. Fenwick...........	A Ground Squirrel.
Dr. A. Nelson..........	Geological Specimen.
Mr. A. G. Baynes.......	A Red-bellied Snake. (*Coluber amvenus.*)
Mr. Geo. Baynes........	A Male Goldfinch.
John Leeming, Esq.....	A large specimen of the American Panther. (*Felis concolor.*)
Mr. Irons, Kingston.....	A Limestone Concretion.
Mr. F. Carlisle.........	A handsome Gilt Frame for the Portrait of Sir J. Kempt.
E. Wurtele, Esq........	A specimen of a Sea Urchin.
Mr. Date..............	A Horse's Tooth taken up by the dredge in the Harbour of Montreal.
J. A. Perkins, Esq......	A Brazilian Nut.
Mr. Wm. Jail..........	A large Hen's Egg weighing 4½ ounces.
W. S. D'Urban, Esq.....	A case of Coleoptera.
Mr. Donegani..........	A Black Hare. (*Lepus Americanus var.*)
Mr. Gough............	Specimen of a Hawk.
	A very large Claw of a Lobster found at Saco, Maine.
Wm. Martin, Esq.......	Specimen of a Hawk.
Hugh Taylor, Esq.......	Specimen of the Summer Duck. (*Anas sponsa.*)
Rev. Mr. Robinson......	A great Horned Owl. (*Bubo Virginianus.*)
Mr. Halliday..........	A Raven. (*Corvus corax.*)
Mr. George Ross.......	Rough Legged Buzzard.
Mr. C. C. Carpenter....	Specimen of Solaster Papposa, cribella oculata, and Uraster Polaris from Labrador.
Dr. Dawson............	Specimen of Uraster rubens from Gaspé.
	Do. do. violacea from Portland Maine.
M. C. Glen.............	Hoary Bat. (*Vespertilio subulatus.*)
Dr. Craik...............	A Flying Squirrel.
Mr. Esdaile............	A Hawk Owl.
Mr. Robert Wright	Do.

LIST OF DONATIONS.—*Continued.*

DONORS' NAMES.	DONATIONS.
Mr. Joshua Bell........	A Pine Grosbeak.
Mr. H. Vennor..........	An Indian Calumet found at Woodstock, C.W.
	Specimen of the Teeth of a Seal.
	Do. Petrified Wood from Bermuda.
Mr. J. Leslie...........	The Antlers of a Caribou.
Joseph Martin, Esq......	Female Sebright Bantam.
	Male do. do.
James Martin, Esq......	The Nest of the Mason Wasp.
Mr. A. G. Vennor......	Three specimens of the Anodon Fluviatilis.
Dr. Durkee, Boston.....	A cast of the head of a Flat-head Indian from the Columbia River.
Mr. Massey............	A piece of Mexican Gold Ore.
Mr. Hilton	A specimen of a Tortoise.
Mr. Dickson...........	Two live Tortoises.
Mrs. Thomson	Two pieces of Petrified Wood from Egypt.
	A curious Spoon from Ceylon.
G. L. Rolland, Esq	Specimen of Copper Ore from Acton, C. E.
	Do. do. do. Lake Superior.
	Do. Silver Ore do. do. do.
Mr. J. Micheson, Phila..	A pair of Canvas Back Ducks.
Mr. J. Jail.............	A pair of Ducks hatched from one Egg.
W. Robertson, Esq., M.D.	Two specimens of a Crustacean from Tahiti.
Duncan Robertson, Esq.	Specimens of Native Cloth from Tahiti.
R. S. Fowler..........	Specimens of Shells from the Stomach of a Flounder.
George Buntin, Esq.....	A pair of Black Ducks.
	Specimen of the Eared Grebe.
	Do. Wilson's Snipe.
	A young Duck Hawk.
Mr. Marler............	A Barred Owl.
Mr. Cunningham.......	Specimens of Copper Ore from Acton.
Thos. E. Blackwell, Esq.	A large Bust of the late Dr. Buckland.
Mr. W. Hunter.........	Specimens of the American Gold Fish.
	French Notes and Coins.
	A pair of Golden-crowned Thrushes.
	A young Bittern caught near Lachine.
	Specimen of the Jumping Mouse. *Meriones (jaculus) acadicus.*
	Specimen of Short Legged Pewitt Fly-Catcher (Female).
	Specimen of the Female Indigo Bird.
J. A. Perkins, Esq......	A large specimen of Mica fromthe Ottawa.
Anonymous......	Three Vials of small Shells.

INDEX.

MONTHLY METEOROLOGICAL REGISTER, ST. MARTINS, ISLE JESUS, CANADA EAST, (NINE MILES WEST OF MONTREAL,) FOR THE MONTH OF OCTOBER, 1860.

Latitude, 45 degrees 32 minutes North. Longitude, 73 degrees 36 minutes West. Height above the level of the Sea, 118 feet.

BY CHARLES SMALLWOOD, M.D., LL.D.

Day of Month.	Barometer—corrected and reduced to 32° F. (English inches.)			Temperature of the Air.—F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.		
	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.
1	30.202	30.161	29.912	27.0	42.8	39.6	.129	.209	.232	.88	.75	.95
2	29.973	29.992	30.026	39.0	49.0	43.8	.232	.297	.269	.95	.84	.93
3	30.119	30.188	140	43.1	53.9	49.0	.261	.288	.315	.95	.70	.89
4	084	29.981	29.955	45.6	46.8	46.0	.293	.305	.286	.95	.96	.92
5	29.903	789	868	46.5	53.7	45.0	.305	.341	.275	.96	.83	.92
6	930	956	30.105	36 0	48.7	35.6	.170	.253	.156	.80	.74	.75
7	923	752	29.564	36.4	50.3	49.0	.184	.254	.315	.85	.65	.89
8	220	218	333	41.4	49.3	39.6	.251	.247	.188	.96	.71	.77
9	334	441	437	37.9	47.7	40.0	.193	.267	.197	.85	.81	.78
10	479	440	434	37.6	53.0	52.4	.193	.251	.294	.86	.63	.79
11	198	633	765	52.0	51.2	39.0	.321	.252	.195	.86	.68	.82
12	820	785	898	32.4	50.0	41.0	.168	.258	.212	.95	.71	.82
13	950	900	30.100	31.6	51.4	38.1	.149	.296	.186	.84	.79	.81
14	30.300	30.185	124	30.5	52.0	40.6	.148	.208	.197	.89	.53	.78
15	29.985	29.894	29.878	57.0	38.1	36.2	.164	.165	.197	.76	.77	.95
16	865	750	798	34.1	57.5	51.0	.182	.302	.302	.95	.66	.82
17	964	30.074	30.184	40.3	54.2	41.0	.210	.308	.241	.86	.74	.95
18	30.229	224	216	36.2	58.2	43.0	.191	.394	.254	.90	.82	.92
19	095	069	140	36.0	63.7	47.9	.179	.416	.280	.87	.72	.88
20	263	200	274	36.3	49.3	39.2	.170	.175	.180	.80	.50	.77
21	080	29.989	29.930	35.3	54.2	40 6	.160	.308	.241	.78	.74	.95
22	29.919	954	978	44.0	47.2	45.6	.289	.225	.299	1.00	.70	.99
23	986	814	756	44.4	54.2	48.7	.289	.335	.310	1.00	.80	.92
24	660	657	752	43.4	54.6	50.0	.254	.362	.335	.92	.87	.93
25	800	814	825	49.7	59.1	51.2	.341	.317	.350	.96	.62	.90
26	673	756	976	49.3	54.2	40.3	.341	.231	.203	.96	.55	.82
27	30.103	30.156	30.339	32.6	55.0	37.0	.162	.349	.190	.89	.81	.84
28	313	214	168	32.7	51.0	46.8	.162	.283	.256	.89	.78	.81
29	031	026	048	45.3	51.6	50.5	.293	.368	.354	.96	.96	.96
30	168	122	098	46.1	55.0	50.6	.305	.355	.354	.97	.84	.96
31	080	003	068	49.9	70.1	62.0	.335	.469	.549	.93	.67	.97

Day of Month.	Direction of Wind.			Horizontal Movement in 24 hours. In miles.	OZONE. Mean amount of, in tenths.	RAIN. Amount of, in inches.	SNOW. Amount of, in inches.	WEATHER, CLOUDS, REMARKS, &c. &c. [A cloudy sky is represented by 10, a cloudless one by 0.]		
	6 a. m.	2 p. m.	10 p. m.					6 a. m.	2 p. m.	10 p. m.
1	E.	S.	S. S. E.	67.70	2.5	1.030	....	1st frost clear.	Rain.	Rain.
2	W. S. W.	W. S. W.	W. by N.	14.42	2.5	....	....	Cu. Str. 10.	Cu. Str. 6.	Cu. Str. 10.
3	W. S W.	W.	W. by W.	8.30	1.0	....	....	" 9.	" 9.	" 9.
4	N. E. by E.	N. E. by E.	N. E. by E.	333.20	1.5	0.480	....	Rain.	Rain.	" 10.
5	S. by E.	W. S. W.	W. N. W.	158.70	2.0	0.051	....	Cu. Str. 4.	Cu. St. 8.	Clear.
6	N.W. by W.	N.W. by W.	W.	345.20	1.5	....	....	Cirr Str 4.	Clear.	"
7	S. S. W.	S. W.	S. E. by E.	17.90	2.0	0.010	....	Clear.	C. C. Str. 6.	Cu. St. 10.
8	N. E.	W.	W.	321.90	3.0	0.800	....	Rain.	" 6.	Clear. Aurora Borealis.
9	W. by S.	W. by N.	N. by E.	411.90	1.5	....	....	Cu. Str. 10.	Cu. Str. 8.	Cu. Str. 10.
10	S. W.	S.	S. by E.	130.60	1.5	....	....	C. C. St. 4.	Cir. Cum. 8.	" 8.
11	S. by E.	W.	W. by N.	414.70	1.0	Inapp.	....	Cu. Str. 6.	Cu. Str. 10.	" 2. Aurora Borealis.
12	W. S. W.	S. S. W.	S. W.	78.80	1.0	....	....	Clear, white frost.	C. C. Str. 8.	Clear. Faint Aurora Borealis.
13	W.	W. S. W.	S. W. by W.	76.30	1.0	....	....	" " "	Clear.	" Do. Do.
14	W. S. W.	S. W.	S.	105.70	1.0	....	....	" " "	Cu. Str. 6.	Cu. Str. 10.
15	N. E.	N. E.	W. S. W.	50.70	2.5	0.100	1.10	Cu. Str. 10.	Rain.	" 10.
16	W. S. W.	W. S. W.	W. by S.	164.40	3.5	0.196	....	Clear, white frost.	Cu. Str. 4.	Rain.
17	E. N. E.	N. E. by E.	N. E. by E.	156.00	2.0	....	....	Cu. Str 4.	" 8.	Cu. Str. 2.
18	N. E. by E.	N. E. by E.	S. by E.	105.20	1.5	....	....	C. C. St. 8.	Clear.	Clear.
19	S.	S. W. by S.	N. E. by N.	64.50	1.0	....	....	Clear, white frost.	Cu. St. 2.	"
20	N. E. by E.	N. E. by E.	N. E. by E.	330.50	1.5	....	....	C. C. St. 4.	" 4.	Cir. Cum. 2.
21	N. E. by E.	N. E. by E.	N. E. by E.	232.80	2.5	2.522	....	" 6.	Rain.	Cu. Str. 10.
22	N. E. by E.	N. E. by E.	N. E. by E.	254 80	4.0	....	....	Cu. Str 10.	Cu. Str. 10.	Clear.
23	N. E. by E.	N. E. by E.	N. by W.	138.60	4 5	....	....	Hazy.	" 10.	Cu. Str. 10.
24	S. W.	W. S. W.	S. W.	110.20	2.5	....	0.17	Cu. Str 10.	C. C. Str. 4.	C. C. Str. 8.
25	S. S. W.	S. S. W.	S. E. by S.	42.00	1.5	....	....	" 00.	" 6.	Clear.
26	S. E. by S.	W. by N.	N. N. W.	14.50	2.0	0.843	....	Rain.	Cu. Str. 10.	"
27	W.	S. S. W.	S. E. by E.	69.60	1.0	....	....	Clear, white frost.	Clear.	"
28	N. E. by E.	N. E. by E.	S. S. E.	191.50	1.5	....	....	Cu. Str 4. "	Cu. Str. 8.	Cu. Str. 10.
29	S. W.	S. W.	W. by N.	218.40	4.0	0.746	....	Rain.	Cu. Str. 10.	" 6.
30	E. by S.	N. E. by E.	N. E. by E.	60.70	3.0	....	....	Cu. St 10.	" 10.	C. C. Str. 6.
31	E. by S.	E. by S.	E. S. E.	144.40	1.5	....	....	C. C. Sr. 6.	" 6.	Clear.

REPORT FOR THE MONTH OF NOVEMBER, 1860.

Day of Month.	Barometer—corrected and reduced to 32° F. (English inches.)			Temperature of the Air.—F.			Tension of Aqueous Vapour.			Humidity of the Atmosphere.		
	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a. m.	2 p. m.	10 p. m.	6 a.m.	2 p. m.	10 p. m.
1	30.097	30.114	30.176	61.3	68.4	62.6	.498	.513	.523	.91	.79	.94
2	121	205	189	51.5	54.3	48.2	.411	.362	.310	.97	.87	.91
3	168	29.901	29.871	46.0	66.1	55.3	.280	.536	.403	.89	.84	.93
4	29.442	624	715	50.5	53.3	43.2	.354	.214	.231	.96	.60	.83
5	599	617	721	39.0	52.7	44.6	.201	.232	.241	.86	.60	.85
6	691	656	679	41.5	42.3	38.1	.235	.199	.208	.91	.74	.91
7	770	796	947	36.0	38.6	33.3	.191	.186	.164	.90	.80	.85
8	30.000	979	30.009	31.3	45.6	40.0	.155	.218	.201	.89	.66	.86
9	29.997	886	29.845	37.1	47.5	33.3	.206	.212	.168	.95	.74	.90
10	784	664	590	34.0	44.6	39.1	.183	.189	.216	.90	.64	.91
11	463	456	426	39.1	49.4	40.1	.216	.297	.254	.91	.85	.92
12	515	513	614	39.0	47.3	45.3	.208	.267	.269	.90	.82	.88
13	795	812	887	42.1	46.2	37.3	.244	.285	.199	.91	.84	.89
14	959	950	991	30.1	47.0	34.2	.145	.232	.167	.89	.73	.88
15	895	917	30.006	33.1	44.2	38.9	.143	.240	.201	.70	.83	.86
16	30.045	30.034	055	35.4	41.0	31.8	.169	.154	.155	.84	.61	.89
17	29.900	29.859	29.697	29.2	36.4	32.7	.142	.129	.162	.88	.61	.84
18	280	218	323	31.1	35.9	33.4	.155	.177	.168	.89	.85	.89
19	165	174	230	34.5	38.9	35.2	.190	.201	.199	.95	.86	.96
20	180	320	422	36.0	39.3	33.8	.186	.173	.162	.86	.73	.84
21	690	621	801	27.0	30.9	28.7	.129	.124	.146	.88	.84	.90
22	879	869	868	22.4	35.0	32.0	.095	.162	.149	.79	.80	.84
23	867	797	604	35.0	40.4	37.5	.183	.203	.214	.90	.82	.95
24	907	135	232	39.1	27.6	22.1	.227	.105	.179	.99	.70	.65
25	465	659	972	20.4	21.1	23.2	.075	.076	.106	.70	.71	.86
26	30.183	30.142	30.054	13.4	24.7	26.3	.057	.120	.123	.72	.89	.87
27	29.665	29.580	29.851	32.3	41.0	32.6	.162	.212	.162	.89	.82	.89
28	894	890	851	20.8	28.3	19.6	.091	.129	.081	.85	.82	.77
29	571	594	502	20.4	34.4	32.0	.082	.169	.169	.74	.84	.88
30	400	314	225	32.1	35.4	33.0	.143	.160	.168	.79	.87	.89
...	......	......	......	......	......	......	......	......	......	......	......	......

Day of Month.	Direction of Wind.			Horizontal Movement in 24 hours. In miles.	OZONE. Mean amount of	RAIN. Amount of, in inches.	SNOW. Amount of, in inches.	WEATHER, CLOUDS, REMARKS, &c. &c. [A cloudy sky is represented by 10, a cloudless one by 0.]		
	6 a. m.	2 p. m.	10 p. m.					6 a. m.	2. p. m.	10 p. m.
1	S. E. by E.	E. S. E.	E.	70.80	2.0	Inapp.	....	Cu. St. 10.	Cu. Str. 10.	C. C. Str. 6.
2	N. E. by E.	N. E. by E.	N. E. by E.	268.50	2.5	....	....	" 10.	" 10.	Cu. Str. 4.
3	N. E. by E.	N. E. by E.	E. N. E.	145.90	1.5	....	....	" 10.	" 4.	" 10.
4	S. W. by W.	W.	W. S. W.	317.00	3.0	0.903	....	Nim. 10.	" 4.	Clear. Aurora Borealis.
5	W.	W.	E. S. E.	178.50	1.5	....	....	Clear.	C. C. Str. 6.	Cu. St. 10.
6	S. E.	E. N. E.	W. S. W.	48.70	3.0	0.516	....	Cu. Str. 10.	Rain.	Rain.
7	W.	W. N. W.	W. by N.	365.70	3.5	0.211	....	Rain.	Cu. Str. 10.	Clear.
8	W. S. W.	W. S. W.	N. E. by E.	106.70	1.5	....	....	Clear, white frost.	C. C. Str. 8.	Cu. Str. 9.
9	W.	S. W.	S. W.	17.20	2.0	....	....	C. Cu.Str. 10.	Clear.	Clear.
10	N. E. by E.	N. E. by E.	N. E. by E.	251.76	3.5	....	....	" 6.	Cu. Str. 10.	Rain.
11	E.	N. N. E.	N.	296.60	2.5	0.536	....	Cu. Str. 6.	" 10.	Cu. Str. 10.
12	W. by N.	W.	N.W. by N.	62.50	2.0	....	....	C. C. Str. 8.	" 4.	" 9.
13	W. by N.	W. by N.	N. W.	115.70	1.5	....	....	" 6.	" 2.	Clear.
14	W.	W. by S.	W. N. W.	70.60	2.0	....	....	Clear, white frost.	Clear.	"
15	N.W. by W.	S. W. by W.	S. S. W.	81.40	2.5	....	....	Cu. Str. 4.	C. C. Str. 10.	Cu. Str. 10.
16	N. E. by E.	S. S. W.	S.	7.40	2.0	....	....	C. C. Str. 6.	Cu. Str. 6.	Str. 1.
17	E. N. E.	N. N. W.	N. by W.	49.80	2.5	....	....	" 4.	" 6.	Cu. Str. 10.
18	N. E. by E.	N. by E.	N. E. by E.	74.30	3.5	Inapp.	0.15	Snow.	" 10.	" 10.
19	N. E. by E.	N. E. by E.	S. S. E.	63.60	3.5	0.372	....	Nim. 10.	" 10.	" 10.
20	S. S. E.	W. by N.	W. N. W.	238.40	4.0	0.140	....	Cu. Str 10.	" 10.	" 9.
21	W. S. W.	W. S. W.	S. by W.	130.40	2.5	....	....	" 4.	" 10.	" 9.
22	W. S. W.	S. W.	S. W.	101.30	2.5	....	....	" 8.	" 10.	" 10.
23	S. by W.	S. E. by E.	S. E. by E.	228.50	3.0	....	Inapp.	" 10.	" 10.	" 4.
24	W. S. W.	W. S. W.	W. S. W.	720.00	3.0	3.190	....	Rain.	Sleet.	" 6.
25	W. by N.	W. by N.	W. S. W.	710.00	2.0	....	....	Cu.Str. 10.	Cu. Str. 6.	" 10.
26	W. S. W.	S. by W.	S. S E.	546.00	2.5	....	....	Clear.	" 6.	" 10.
27	S. by W.	W. S. W.	W.	314.00	2.5	....	3.54	Snow.	" 6.	Clear.
28	W.	N. N. W.	W. S. W.	119.00	2.5	....	....	Clear.	" 8.	"
29	S. W.	S. W.	W.	57.10	2.0	....	....	C. C. Str. 4.	Sleet.	Cu. Str. 10.
30	W.	W.	N. E. by E.	69.10	2.0	Inapp.	Inapp.	Cu. Str. 10.	Snow.	Sleet.
...	....	....	....	....	......	....	....	....	....	....

REMARKS FOR OCTOBER, 1860.

Barometer .... { Highest, the 27th day, 30·339 inches. Lowest, the 11th day, 29.198 " Monthly Mean, 29.919 " " Range, 1.141 " }

Thermometer ... { Highest, the 31st day, 70°1. Lowest, the 1st day, 26°1. Monthly Mean, 45°48. Monthly Range, 44°0. }

Greatest intensity of the Sun's rays, 85°0.
Lowest point of Terrestrial radiation, 22°2.
Mean of Humidity, .839.
Amount of Evaporation, 1.32 inches.
Rain fell on 11 days, amounting to 4.787 inches; it was raining 69 hours and 44 minutes.

Snow fell on 2 days, amounting to 1·27 inches; it was snowing 11 hours.
Most prevalent wind, the N. E. by E.
Least prevalent wind, the E.
Most windy day, the 11th day; mean miles per hour, 16.88.
Least windy day, the 3rd day; mean miles per hour, 0.23.
Aurora Borealis visible on 4 nights.
The Electrical state of the Atmosphere has indicated high tension.
Two distinct and smart shocks of an earthquake were felt here at 5·55 a.m. on the morning of the 17th day, the wave passing from E. to W. The sound wave was distinctly perceptible after the passage of the earth wave.

REMARKS FOR NOVEMBER, 1860.

Barometer. ...... { Highest, the 2nd day, 30.205 inches. Lowest, the 24th day, 28.950 " Monthly Mean, 29.730 " Monthly Range, 2·255 " }

Thermometer. { Highest, the 1st day, 71°4. Lowest, the 26th day, 12°0. Monthly Mean, 37°59. Monthly Range, 59°4. }

Greatest intensity of the Sun's rays, 82°1.
Lowest point of terrestrial radiation, 12°0.
Mean of humidity, .839.
Rain fell on 10 days, amounting to 5.898 inches; it was raining 18 hours 29 minutes.

Snow fell on 4 days, amounting to 3.69 inches, it was snowing 7 hours and 50 minutes.
Most windy day, the 24th day; mean miles per hour, 29.35.
Least windy day, the 16th day; mean miles per hour 0.33.
Most prevalent wind, the S. W.
Least prevalent wind, the E.
Aurora Borealis visible on 1 night.
The Electrical state of the Atmosphere has indicated constant and moderate intensity.
The Symmetrical wave was well marked during the month.
Snow birds *(Plectrophanes Nivalis)* 1st seen on the 3rd day.